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INDEX.

	PAGE.
American Storm, An	68
Anemometer and Cowl Testing at Kew Observatory	38
Anemometer Constants, The Determination of	56
Anticipation fulfilled, an	172
A Strange Story	136
Atlantic Weather Maps 2	49
August 2–3, Thunder and Hailstorm 97	125
Australian Drought	85
Bibliography, Meteorolgical, 17, 65	156
British Association at Sheffield..121	146
Canadian Rain Gauges	70
Channel Islands, Rainfall of	137
Cheap Mountain Rain Gauge	181
Climatological Stations	196
Concerning our Tables	1
Conductors, Lightning	156
Cowl and Anemometer Testing at Kew Observatory	38
Croydon Sanitary Institute, 159, 174	187
December, 1879, The Frost of, in England and Italy	179
December, 1879, Low Temperatures in	185
Determination of Anemometer Constants	56
Drought, South Australian	85
Easter at the Sorbonne	52
East Yorkshire Whirlwind	125
Errata	48
Excessive Rainfall 71	91
Extraordinary Meteor.....31	40
Floods, Swiss	76
Fog Bow	192
Fog Particles, the size of	190
Fogs, Prevalence of	39
French Hydraulics	43
Frost of December, 1879, in England and Italy, The	179
Frost of 1795, The	172
Frost Phenomena 2	40
Hailstones: Relation of Weight to Size	115
Hailstorm and Thunder of August 2nd and 3rd (the Richmond Hailstorm) 97	125
Heat in Madrid	96
Java, Meteorology in	143
Late Winter, The	22
Latitudes, &c., of Stations.....10	12
Lightning Conductors	156
Low Temperatures in December, 1879	185
Lightning, Two Queries respecting.	168
Madrid, Heat in	96
Maps, Atlantic Weather 2	49
Meteor Extraordinary.....31	40
Meteorological Bibliography, 17, 65	156
Meteorological Notes ...14, 30, 47, 63, 79, 95, 119, 135, 150, 167	183
Meteorological Post-Card	32
Meteorology in Java	143
Meteorology in Portugal	169
Mexican Meteorology	85
Mountain Rain-Gauge, Cheap	181
Nancy, Temperature at, in Dec., 1879	187
New Westminster, Observations at	32
North Wales Rainfall	131
North-West of England Rainfall, 120	130
Parhelia (with Engravings)	138
Phenomena of Frost 2	40
Pollen Showers	96
Portugal, Meteorology in	169
Post-Card, Meteorological	32
Prevalence of Fogs, The	39
Publications, Signal Office	81
Rainbow, Water Reflection	131
Rain Drops, Shape of 6	24
Rainfall and Temperature, Monthly, 13, 29, 46, 62 78, 94, 118, 134, 149, 166, 182,	194
Rainfall in the N.W. of England 120	130
Rainfall, Excessive 71	91
Rainfall of the Channel Islands, The	137
Rainfall, North Wales	131
Rainfall Stations	153
Rainfall, Trinidad	69
Rainfall Zones Suggested	32
Rain Gauge, Cheap Mountain	181
Rain Gauges, Canadian	70
Rainless Weeks	116
Relation of weight to size, Hailstones	115

PAGE.

REVIEWS—
Meteorology of North Atlantic ... 7
Stanford's Compendium of Geography ... 9
Instruction to Observers connected with the Meteorological Service of the Dominion of Canada 41
Negretti and Zambra's Encyclopædic Catalogue ... 42
Meteorological Observations made at the Adelaide Observatory during the years 1876 and 1877 72
Ministère de l'Instruction Publique; Bureau Central Meteorologique de France; Instructions Meteorologiques ... 73
Barbados Agricultural Gazette ... 88
The Meteorology of Croydon ... 88
Modern Meteorology ... 88
Of the Meteorology of Bute for the year 1878 ... 89
On the Horizontal Visual Penetrability of the Atmosphere ... 89
The Collinsville Tornado of April 14th, 1879 ... 157
The Weather and Climatic Changes ... 158
Richmond Hailstorm ... 97 125
Sanitary Institute at Croydon ... 159 174 187
Shape of Rain Drops ... 6 24
Sheffield, British Association at .. 121 146
Showers, Pollen ... 96
Signal Office Publications ... 81
Size of Fog Particles ... 190
Sorbonne, Easter at ... 52
South Australian Drought ... 85
Stations, Climatological ... 180
Stations, Rainfall ... 153

PAGE.
Storm, An American ... 68
Storm, The Tay Bridge ... 189
Strange Story, A ... 136
Stratus and Cirro-stratus ... 90, 114 130
Suggested Rainfall Zones ... 32
Supplementary Table, 10, 28, 45, 55, 77, 93, 117, 133, 148, 165, 184 193
Swiss Floods ... 76
Tables, Concerning our ... 1
Tay Bridge Storm ... 189
Temperature at Nancy in December, 1879 ... 187
Testing of Cowls and Anemometers at Kew Observatory ... 38
The Extraordinary Meteor of March 24th ... 40
The Sanitary Institute at Croydon 159 174
The Winter of 1878-9 ... 33
Thirty Winters ... 59 71
Thunder and Hailstorm of August 2nd-3rd ... 97 125
U.S. Signal Office Publications ... 81
Trinidad Rainfall ... 69
Two Queries respecting Lightning ... 168
Water Reflection Rainbow ... 131
Weather in each Month, 15, 26, 43, 60, 75, 92, 129, 151, 154, 173 191
Weather Maps, Atlantic ... 2 49
Weeks, Rainless ... 116
Whirlwind in East Yorkshire ... 125
White Fog Bow ... 192
Wind Force ... 132
Winter of 1878-9 ... 33
Winter Temperatures in Stevenson's Stands, 1878-9 ... 61
Winter, The late ... 22
Winters, Thirty ... 59 71

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLVII.] FEBRUARY, 1879. [PRICE FOURPENCE or 5s. per ann. post free.

CONCERNING OUR TABLES.

WE have to give an unusual amount of tabular matter this month, and think that a few words are desirable respecting it.

It is probably known to most of our readers that this periodical was originally a sort of monthly supplement to the annual volumes of *British Rainfall*. It was, however, thought well to add to the rainfall details, notes upon other branches of meteorology, and our efforts in that direction met with sufficient appreciation to cause the development of these supplements into the periodical which we have had the pleasure of carrying on for thirteen years.

Although the functions of the *Meteorological Magazine* as a medium of unrestrained communication among meteorologists have developed far beyond our anticipations, we have never neglected the original object whence it arose; on the contrary, while No. I. contained the total rainfall at 50 stations, No. CLVI. contained that at 116, and on and after this month we hope to give records from 138 stations.

Our readers must not, however, imagine that we intend overloading the magazine with tables—far from it. The large space occupied this month is purely exceptional, and arises from our giving complete tables of the geographical positions of all the stations. This information is extremely valuable to those of our English readers who uitlize the rainfall data which we give, and to residents in other countries it is indispensable. The positions assigned are mostly correct to the nearest minute, as they have nearly all been taken from the Ordnance maps, and they are certainly accurate enough for the purpose intended, viz., enabling readers to find the localities designated.

It will be seen that the rainfall for January at the supplementary stations is given along with the latitudes and longitudes; for the regular stations this was of course impossible.

ATLANTIC WEATHER MAPS.

JUST at the moment of going to press we have received from Prof. Cleveland Abbe, of the Signal Office, Washington, a note respecting the article upon the above subject in our last number, and along with it some charts of "Ocean Storm-tracks." We postpone until next month further remarks upon the subject except on one point: of the following words on page 177 of Vol. XIII., "and the United States Government have printed masses of figures, *but no maps and no discussion of the data*," those in italics are incorrect; they have printed some maps involving the discussion of the European synchronous observations. The explanation of the error is, that although the Signal Office is known to be very liberal in distributing its publications, the *Meteorological Magazine* has, we are sure unintentionally, been omitted from its list; and although, partly by presents from other persons, and partly by purchase, we have a large collection of publications of the Signal Office, it is far from perfect, and does not contain any maps similar to those now sent.

FROST PHENOMENA.

To the Editor of the Meteorological Magazine.

SIR,—The winter of 1878-9, though raising the rate of mortality, and causing much hardship to the poor, will have done good in many ways. It will have rid our agriculturalists of many of the insect pests that have gained ground during the recent mild seasons, and possibly, in other countries, it may have checked the ravages of the phylloxera and the progress of the colorado beetle; it will have been a great boon to the fast increasing army of figure skaters; and it will, let us hope, have served to dispel some of the fallacies, both meteorological and botanical, of which we have lately heard too much; notably, the supposed change in our climate, the ability to judge of a coming winter by the abundance or scarcity of certain berries, and the advantage of planting our parks or gardens with tropical trees, sure to be utterly disfigured, if not killed outright, by the first of the severe winters, which recur, with some regularity, at intervals of about seven years.

Mr. Cordeaux's prediction, on 10th December, 1878, of a severe winter, based as it was on the unusual arrival of migratory birds (see *Times*, 12th December, 1878), was well timed, and has been triumphantly successful; but what prophet, of the more usual type, would have ventured to predict a min. temperature of 7°·7 on Christmas Day, followed by a min. of 50° on December 31st, the latter 5°·4 above the min. of 21st June last (the longest day of the year), and 6°·8 above that of June 20th!

The believers in the berry theory (the same, probably, who *insist* on our weather being influenced by the moon) will be at a loss to

account for a total absence of beech nuts, and a scarcity of thorn, holly and other berries, being followed by a November-January period of most unusual cold; and those who have written to the papers, stoutly defending the hardiness of their pet tree, the "blue gum" *(eucalyptus globulus)*, will be dismayed to find it killed, though standing, as it has done here, by the side of such plants as the fan palm *(chamærops excelsa)* and bamboo *(bambusa metake)*, which, without any protection, have survived the frost uninjured.

The continuance, rather than the severity, of the frost has led to the low mean temperatures.

From 17th to 31st January, both inclusive, there was a total range of only 12° (24° and 36°), while the sun was "conspicuous by his absence" during the whole of that period. There were 23 frosts here during December, and 27 in January, with skating on 37 or 38 of the 62 days. From December 15th to 24th, and from January 3rd to 6th, a succession of frosts occurred, with the wind almost continuously due W., and from January 16th to 31st, a succession of slight frosts, with the wind steady in the N.E.

I am, Sir, yours faithfully,

PERCY BICKNELL.

Forgrove, Beckenham, 1st Feb., 1879.

	Dry Bulb, 9 a.m.	Max.	Min.
December, 1878.			
Mean.....	33°·5	38°·2	28°·1
Highest...	53 ·4 on 30th	55 ·1 on 30th	50 ·0 on 31st.
Lowest ...	20 ·0 on 13th	29 ·5 on 13th	7 ·7 on 25th.
January, 1879.			
Mean.....	32°·4	36°·6	27°·8
Highest ..	47 ·5 on 3rd	49 ·0 on 3rd	46 ·5 on 1st.
Lowest ...	21 ·3 on 12th	27 ·6 on 11th	18 ·1 on 12th.

To the Editor of the Meteorological Magazine.

SIR,—In case you may be collecting comparative temperatures of the late frost, I send you some of my own notes.

The winter effects on the landscape have been most beautiful, especially when everything was covered with rime one-third to half an inch thick in crystal laminæ. I enclose for your acceptance a not very good photograph of an araucaria taken on the afternoon of Dec. 14th, too late for the light.

On Christmas night the trees were all coated with frozen rain, so that the form of every leaf could be taken off in ice.

The night of Jan. 10th and morning of Jan. 11th, a little light snow fell, in the largest and most beautiful and varied star crystals I have ever seen.

Saturday night last (Feb. 1st) we had a shower of clear ice drops, some single, but most of them clustered in the most fantastic forms. The effect was as if rain had fallen through a freezing stratum,

then through a warmer one that partially melted them, and then through another which froze them again.

Excuse the roughness of these notes.—Yours truly,

B. WOODD SMITH.

Branch Hill Lodge, Hampstead Heath, Feb. 5th, 1879.

To the Editor of the Meteorological Magazine.

SIR,—You may be glad of the results of observations on the appalling winter we have just emerged from. My records are now complete for 30 years, and they give no similar instance of uniform persistent low temperature. The means of the last three months are :—

November ... 36°·8 December ... 31°·1 January ... 28°·0

making a mean of only a trifle above freezing point. Our lowest reading, 15°, has often been exceeded, viz., in March and December, 1853, 1854; February and December, 1855, 1856, 1857, 1858; March and December, 1859, 1860, 1861, 1864, 1865, 1867; January and December, 1870, and 1874.

The very low temperature of November and January appear to be the most striking features of the winter, which has been almost continuous for nine weeks.—Yours truly,

W. LUCAS.

Hitchen, 9th February, 1879.

To the Editor of the Meteorological Magazine.

SIR,—Should the following particulars of the weather experienced here during November and December, 1878, and January, 1879, be of any interest, they are much at your service. Out of 92 days composing the period in question, 73 of them showed a frost on grass, 55 a frost in the stand at 4 ft. above it, and 14 a frost throughout the 24 hours, as indicated by the ther. never rising above 32°. The highest temp. in the three months was 53°·4 on the 31st of December (during a short thaw), the lowest, 4°·2, on the 12th of January, on which same day the terrestrial radiation ther. *in vacuo* on grass sank to 2° *below* zero. The adopted mean temperature of Nov., Dec., and January, as derived from the simple arithmetical mean of the daily maxima, minima, and 9 a.m. and 9 p.m. observations, is 34°·5. Of rainfall during the time above quoted, we have had 43 days (on 11 of which it snowed), yielding an amount of 8·54 inches, 3·35 in. of this falling between the 25th of December and the 3rd January.

From the 23rd to the 31st January no glimpse of the sun (even of the smallest description) was ever discernible. To-day, the 1st of February, is not only marked by a continuance of the frost and gloom, but by a heavy fall of snow in addition.—I am, Sir, yours faithfully,

F. BONNYCASTLE GRITTON, F.M.S.

Eglinton Villa, Holt, Trowbridge, Wilts, 1st February, 1879.

NOTE.—The instruments from which the above readings have been taken are all Kew verified.

To the Editor of the Meteorological Magazine.

SIR,—The mean temperature of the last three months has been 34°·6, which is fully 6° below the average.

Cold weather set in on October 27th, and, with a few slight breaks, endured until February 5th.

In November the mean was...	38°·9
In December the mean was...	33°·5
In January the mean was	31°·3

The most severe frost occurred on the morning of January 12th, when the thermometer here registered 11°·5. It was the coldest month we have had since February, 1855, when the mean temperature was 29°·4.—Yours faithfully,

W. F. DENNING, F.R.A.S.

Tyndale House, Ashley Down, Bristol, Feb. 7th, 1879.

To the Editor of the Meteorological Magazine.

SIR,—I have to call your attention to the very low temperature which prevailed here between Dec. 10—26, as shown by thermometers 4 feet from ground, enclosed in a Stevenson box.

	Max.	Min.	Mean.
Dec. 10 ...	21° ...	14° ...	17°·5
,, 11 ...	20 ...	10 ...	15 ·0
,, 12 ...	14 ...	2 ...	8 ·0
,, 13 ...	12 ...	—4 ...	4 ·0
,, 14 ...	15 ...	—2 ...	6 ·5
,, 15 ...	20 ...	6 ...	13 ·0
,, 16 ...	24 ...	10 ...	17 ·0
,, 17 ...	15 ...	7 ...	11 ·0
,, 18 ...	19 ...	14 ...	16 ·5
,, 19 ...	31 ...	21 ...	26 ·0
,, 20 ...	36 ...	24 ...	30 ·0
,, 21 ...	24 ...	14 ...	19 ·0
,, 22 ...	21 ...	11 ...	16 ·0
,, 23 ...	19 ...	15 ...	17 ·0
,, 24 ...	20 ...	14 ...	17 ·0
,, 25 ...	10 ...	—2 ...	4 ·0
Giving mean daily temperature			14°·8

The mean temperature of December was 24°·0.

Yours truly,

JOHN COPPIN.

Bingfield, Corbridge-on-Tyne, Jan. 23rd, 1879.

To the Editor of the Meteorological Magazine.

SIR,—You may possibly care to be informed that on the night of the 11-12th inst., the registering thermometer in my stand, at 4 ft. from the ground, and of course thoroughly protected from radiation, indicated a minimum temperature of 10°, and had not risen *in the least* up to 9.10 a.m. on the 12th. At the latter hour the minimum thermometer on the snow stood at 2°, but registered the unusually low reading of —3° as the lowest temperature of the night. At 0·30 p.m. on the same day it stood at 32°·5 whilst lying on the

snow, which was melting under the influence of a warm westerly breeze. So many observers appear to have allowed their grass minimum thermometer to remain buried under the snow, that, as yet, I have not heard of any similar low readings in this neighbourhood.—Yours very truly, F. F. TUCKETT.

Frenchay, near Bristol, Jan. 21st, 1879.

THE SHAPE OF RAIN-DROPS.

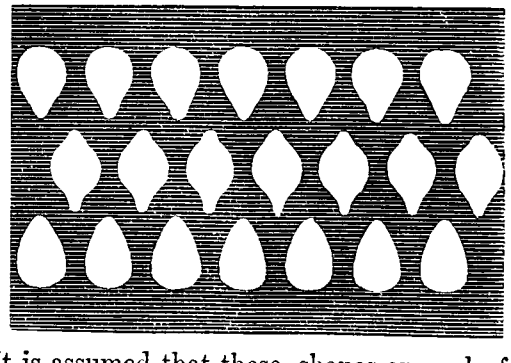
To the Editor of the Meteorological Magazine.

SIR,—This subject appears never to have received any attention from meteorological observers, although with the aid of recent discoveries it would appear possible to photograph falling rain, and this would definitely settle the question.

In the absence of photographs, it can only be discussed from a theoretical point of view, and the following ideas are therefore sketched out for consideration.

Rain-drops have a certain weight, which causes them to fall to the earth, and therefore their shape probably approaches to spherical; but as they fall through the air, their weight would cause them constantly to change their shape, each part of the drop having the tendency to fall. If then the rain-drops are completely spherical at first, the water would run out towards the middle of the lower part of each drop, being the point of greatest weight; this would cause the drops to be pointed at the base, and they would assume a balloon shape. In the next stage the main portion of the rain-drop would be progressing towards the lower part, and thus both the top and bottom would be pointed. The third stage is at last reached, and in this the main portion of the rain-drop would have been carried by its own weight to the lower part, and the drop would then be pear-shaped.

These three supposed shapes are shewn in the following sketch, which represents a small portion of a shower of rain.



Of course it is assumed that these shapes are only found during a calm, and the effect of wind would be to vary the forms and render them more attenuated.

FREDERICK E. SAWYER, F.M.S.

REVIEWS.

The Meteorology of the North Atlantic during August, 1873. By CAPTAIN HENRY TOYNBEE. 4to and Atlas of Plates. Stanford, 1878.

IN our last number we gave so brief a notice of the above work that we return to it, and especially because we think that a short review will be instructive to our readers, and may lead some to examine the work for themselves.

The labour necessary to chart such a number of observations must have been considerable, especially when we see that the bulk of the observations was obtained from ordinary ships' logs; but the work, though dealing chiefly with observations made on board ships, is by no means limited to the sea; the information obtained from the ships' logs has been used as a link connecting the American and European observations, and, to quote Captain Toynbee's own words—

"Although the chief object of this work is to throw light on the rise and progress of the hurricane, the charts also illustrate the ordinary circulation of the air over the North Atlantic and the neighbouring countries of North America and Europe during August, 1873."

The letterpress which accompanies the charts is written in such a manner that it may easily be understood by the student of meteorology, and the remarks and conclusions derived from a study of the data will be found to be full of valuable information.

We see from the "Remarks on the Hurricane" that the first indication of its existence was observed on August 12th, in about 11° N. and 28° W., and its course is traced to the coast of Newfoundland on the 26th, when it seems to have broken up, though apparently the disturbance afterwards took the form of a slight area of low pressure which crossed to the British Isles on the 31st, and to Norway on September 2nd.

The following quotations from the work we consider peculiarly interesting, since they strike us as somewhat recouping the Americans for the pains they are taking just now with respect to warning us of coming storms :—

"*Possibility of Warning America.*—Its existence was known on the 18th at St. Thomas, a week before the damage was done on the American coast, and on the 21st the residents at Bermuda were fully aware of its existence and could have foretold its track; from both of these places warnings might have been sent to America if telegraphic communication had existed."

"*Meeting between Area of High Pressure and Hurricane.*—It seems most probable that much of the destructive force of the northerly wind, which did so much damage on the 25th, was caused by a meeting between an area of high pressure moving from the north-westward and one of low pressure connected with the hurricane which was coming up from the S., and that more complete telegraphic communication would have made it possible to warn the coasts of the serious results to be expected from such a meeting, many hours before they experienced the gale."

The direction of the wind with regard to the bearing of the hurri-

cane centre is made a point of especial importance, and is extremely well handled; the substance of the conclusion is that the wind does not blow in circles, but in the N. hemisphere

With the wind N. the centre of a hurricane probably bears E.S.E. or more Sly.
,, ,, E. ,, ,, ,, S.S.W. or more Wly.
,, ,, S. ,, ,, ,, W.N.W. or more Nly.
,, ,, W. ,, ,, ,, N.N.E. or more Ely.

this is followed by good practical suggestions for the seaman.

Then follows the mean height of the barometer, and force of wind at given distances from the centre of the hurricane.

Distance from centre	Near centre	100	200	300	400	500	Miles.
Mean Barometer ...	27·95	28·68	29·28	29·63	29·83	29·95	Inches.
Mean Wind force ...	12·0	9·8	8·2	7·1	6·2	5·6	Beaufort's Scale.

A mere glance at the charts is sufficient to show the normal circulation of the air in the month of August, which may be described as follows:—In the centre of the North Atlantic there is an area of high barometric pressure, around which the winds blow in the manner known as anti-cyclonic, so that on the northern side of this area the winds are westerly, on the eastern side they are northerly, on the southern side they are easterly, and on the western side they are southerly.

The difference of barometric pressure is greatest on the northern side of the area of high pressure, and this part may be considered the channel followed by the *systems* which cross to our Islands from the Atlantic.

Since the British Islands are situated to the north-eastward of the area of high pressure which is situated in the middle of the Atlantic, the following remark is of considerable importance to us at home:—

"*N.E. end of Area of Highest Pressure.*—At the N.E. end of the area of highest pressure there is generally a branching of the isobars, part going on to the E. and N.E., whilst others turn sharply to the S.E., S., and S.W., the winds follow the isobars so that to the N.E. of a westerly wind there will be south-westerly winds, whilst to the S.E. of it there will be north-westerly and northerly winds, the latter being due to a circulation of air round the area of *high* pressure, whilst the former are due to its being drawn towards an area of *low* pressure. This fact shows the importance of knowing the relative distribution of areas of high and low pressure when endeavouring to estimate the probable wind in a certain district."

"In the month of August, 1873, the N.E. corner of the area of highest pressure lay very frequently near the entrance of the English Channel, causing a tendency for north-westerly winds there, which winds were not disturbed by the ordinary changes which passed over the British Islands from the westward. This near approach of the area of highest pressure to the Channel in summer makes it probable that north-westerly winds may be strong there, whilst the neighbouring south-westerly winds are relatively light. In winter, when the highest pressure often lies over France, south-westerly winds may be strongest."

We do not recollect having seen any explanation by Capt. Toynbee of the unique form of the isobars upon his maps. In everybody

else's maps they run in graceful curves, but in those issued by Capt. Toynbee they ziz-zag about like what Mr. Nasmyth so truthfully called "painter's lightning." Very probably this peculiarity indicates that the position of each is computed instead of being, as is very usual, guessed at, and we do not for a moment impugn their accuracy, but, as it is impossible to believe that they really turn off at acute angles, they would gain both in actual and in apparent truthfulness if the corners were rounded.

While remarking upon draughtsmanship we suggest for Capt. Toynbee's consideration the advisability of either putting some lettering on the land, or putting wave lines round the coasts, or stippling all the land—if faintly done in blue it would render the charts much clearer, and would not at all hinder the prominence of the meteorological data.

Stanford's Compendium of Geography and Travel. AFRICA, *by* KEITH JOHNSTON. Stanford, London: 8vo, 610 pages, maps and engravings.

NOBODY has defined, or can define, the boundary line between descriptive and physical geography, or between physical geography and meteorology. There are, doubtless, many geographical works which could not claim notice in these pages, but meteorologists who neglect the work before us will miss a most valuable paper, giving the results of an entirely novel mode of investigating the seasonal distribution of African rainfall. We cannot spare space for epitomising the 34 pages in which Mr. Keith Johnston sums up the results of his investigations, and besides it could not be well done without the reproduction of the set of a dozen maps; we therefore leave it with the plain but true statement that it affords better information respecting the rainfall of Africa than any publication extant.

Lastly, a few words as to the rest of the volume, which is one of a series, based upon translations of Hellwald's *Die Erde und ihre Völker.* It is really a condensation of nearly all the books of travels ever written—a labour so vast that it may well originally come from Germany—but it does not read like a translation, nor has it the heaviness which the mass of information contained in it would imply. Reading it, is like listening to the personal narrative of an educated man who has himself made all the journeyings "Across the Dark Country" from the fifteenth century to the present time. If the rest of the series are as interesting as is Africa, we consider that a valuable addition will have been made to English literature.

The present troubles with Cetywayo (pronounced Ketchwayo) lend a melancholy interest to the portion of the work dealing with the Zulus and their military organization.

LATITUDES AND LONGITUDES OF THE SUPPLEMENTARY STATIONS, AND RAINFALL FOR JANUARY THEREAT.

Div.	COUNTY.	STATION.	Latitude.	Longitude.	Total Rain.
II.	Kent	Margate, Acol	51° 21′ N.	1° 19′ E.	2·04
,,	Sussex	Littlehampton	50 48 ,,	0 32 W.	3·30
,,	,,	Horsham, Swallowfield	51 1 ,,	0 18 W.	...
,,	,,	Hastings, Manor House	50 52 ,,	0 36 E.	2·59
,,	,,	Hailsham	50 52 ,,	0 16 E.	...
,,	Hampshire	I. of W., St. Lawrence	50 35 ,,	1 14 W.	4·38
,,	,,	Strathfield Turgiss	51 20 ,,	1 0 ,,	3·24
III.	Buckingham	Great Missenden	51 42 ,,	0 42 ,,	2·60
,,	,,	Winslow, Addington Manor	51 57 ,,	0 55 ,,	2·77
,,	Oxford	Oxford, Magdalen Col.	51 45 ,,	1 15 ,,	3·13
,,	Northampton	Northampton, St. Giles' Street	52 14 ,,	0 54 W.	2·17
,,	Cambridge	Cambridge, Merton Villa	52 13 ,,	0 8 E.	1·50
IV.	Essex	Harlow, Sheering	51 48 ,,	0 11 ,,	2·49
,,	Norfolk	Diss	52 22 ,,	1 7 ,,	1·40
,,	,,	Swaffham	52 39 ,,	0 42 ,,	1·04
,,	,,	Hindringham	52 53 ,,	0 57 E.	·87
V.	Wilts	Salisbury, Alderbury	51 3 ,,	1 44 W.	3·54
,,	,,	Calne, Compton Bassett	51 27 ,,	1 56 ,,	3·35
,,	Dorset	Beaminster Vicarage	50 48 ,,	2 44 ,,	5·32
,,	Devon	Dartmoor Prison	50 33 ,,	4 0 ,,	9·24
,,	,,	Torrington, Langtree Wick	50 55 ,,	4 11 ,,	4·42
,,	,,	Lynmouth, Glenthorne	51 14 ,,	3 43 ,,	4·11
,,	Cornwall	St. Austell, Cosgarne	50 21 ,,	4 48 ,,	8·11
,,	Somerset	Taunton, Hoveland's Terrace	51 1 ,,	3 6 ,,	4·27
VI.	Gloucester	Bristol, Ashleydown	51 28 ,,	2 35 ,,	3·98
,,	Shropshire	Wem, Sansaw Hall	52 48 ,,	2 44 ,,	·77
,,	Stafford	Cheadle, The Heath House	52 58 ,,	1 57 ,,	2·24
,,	Warwick	Bickenhill Vicarage	52 26 ,,	1 44 ,,	2·14
VII.	Leicester	Melton Mowbray, Coston Rec.	52 48 ,,	0 45 ,,	1·18
,,	Lincoln	Horncastle, Bucknall	53 13 ,,	0 15 ,,	1·26
VIII.	Lancashire	Walton-on-the-Hill	53 30 ,,	3 8 ,,	1·66
,,	,,	Broughton-in-Furness	54 17 ,,	3 12 ,,	2·50
IX.	York	Wakefield, Stanley Vic.	53 43 ,,	1 28 ,,	1·10
,,	,,	Ripon, High Bank, Mickley	54 11 ,,	1 37 ,,	1·17
X.	Durham	Gainford	54 32 ,,	1 44 ,,	·89
,,	Northumberland	Haltwhistle, Unthank Hall	54 58 ,,	2 26 ,,	·67
,,	Westmoreland	Shap, Copy Hill	54 31 ,,	2 41 ,,	1·50
XI.	Monmouth	Llanfrechfa Grange	51 38 ,,	2 58 ,,	4·59
,,	Carmarthen	Llandovery	52 0 ,,	3 48 ,,	2·97
,,	Pembroke	Solva	51 52 ,,	5 12 ,,	2·98
,,	,,	Llechryd, Castle Malgwyn	52 3 ,,	4 35 ,,	2·42
,,	Radnor	Rhayader, Nantgwillt	52 16 ,,	3 35 ,,	3·53
,,	Montgomery	Carno, Tybrittle	52 34 ,,	3 32 ,,	2·30
,,	Merioneth	Corwen, Rhug	52 59 ,,	3 24 ,,	1·22
,,	Carnarvon	Port Madoc	52 56 ,,	4 7 ,,	1·91
,,	Isle of Man	Douglas	54 9 ,,	4 28 ,,	...
XII.	Kirkcudbright	Carsphairn	55 11 ,,	4 17 ,,	1·99
,,	Roxburgh	Melrose, Abbey Gate	55 37 N.	2 48 W.	1·50

Div.	COUNTY.	STATION.	Latitude.	Longitude.	Total Rain.
XIV.	Lanark	Lanark, Baronald	55° 38′ N.	3° 47′ W.	...
XV.	Argyll	Islay, Gruinart School	55 49 ,,	6 20 ,,	2·60
XVI.	Fife	St. Andrew's, Cambo House	56 18 ,,	2 43 ,,	2·35
,,	Perth	Aberfeldy H.R.S.	56 36 ,,	3 52 ,,	1·25
XVII.	Banff	Tomintoul	57 14 ,,	3 23 ,,	2·52
,,	,,	Keith H.R.S.	57 35 ,,	2 53 ,,	2·33
,,	Elgin	Forres H.R.S.	57 38 ,,	3 36 ,,	1 93
XVIII.	Ross	Strome Ferry H.R.S.	57 21 ,,	5 32 ,,	3·01
,,	,,	Lochbroom	57 51 ,,	5 12 ,,	2·44
,,	,,	Auchnasheen H.R.S.	57 36 ,,	5 5 ,,	2·49
,,	,,	Tain, Springfield	57 49 ,,	4 4 ,,	·77
,,	Inverness	Loch Shiel, Glenfinnan	56 50 ,,	5 30 ,,	3·72
,,	,,	Dalwhinnie H.R.S.	56 56 ,,	4 15 ,,	...
XIX.	Sutherland	Lairg H.R.S.	58 3 ,,	4 24 ,,	...
,,	Caithness	Altnabreac H.R.S.	58 27 ,,	3 33 ,,	·87
,,	,,	Watten H.R.S.	58 29 ,,	3 19 ,,	1·45
XX.	Cork	Fermoy, Glenville	52 3 ,,	8 27 ,,	7·66
,,	Kerry	Tralee, Godfrey Place	52 16 ,,	9 42 ,,	3·84
,,	Tipperary	Cahir, Tubrid	52 19 ,,	7 58 ,,	4·34
,,	,,	Tipperary, Henry Street	52 28 ,,	8 9 ,,	3·50
,,	Limerick	Newcastle West	52 27 ,,	9 5 ,,	3·55
,,	Clare	Kilrush	52 37 ,,	9 29 ,,	2·21
,,	,,	Corofin	52 57 ,,	9 6 ,,	3·61
XXI.	Kilkenny	Kilkenny, Butler House	52 40 ,,	7 15 ,,	3·11
,,	Kildare	Naas, Ballymore Eustace	53 8 ,,	6 38 ,,	...
,,	Dublin	Kilsallaghan, Corrstown Ho...	53 27 ,,	6 17 ,,	2·15
,,	Meath	Navan, Balrath	53 38 ,,	6 36 ,,	2·04
,,	Westmeath	Athlone, Twyford	53 26 ,,	7 50 ,,	2·56
,,	,,	Mullingar, Belvedere	53 30 ,,	7 22 ,,	2·74
XXII.	Galway	Ballinasloe, Kilconnell	53 19 ,,	8 15 ,,	3·14
,,	,,	Clifden, Kylemore	53 33 ,,	9 52 ,,	7·81
,,	Mayo	Crossmolina, Enniscoe	54 4 ,,	9 19 ,,	...
,,	Leitrim	Carrick-on-Shannon	53 56 ,,	8 5 ,,	2·92
,,	,,	Dowra	54 13 ,,	7 56 ,,	1·78
XXIII.	Monaghan	Rockcorry	54 6 ,,	7 1 ,,	2·18
,,	Down	Warrenpoint, Summer Hill	54 44 ,,	6 15 ,,	4·35
,,	,,	Newtownards	54 36 ,,	5 42 ,,	2·12
,,	Antrim	Larne, Carnlough	54 59 ,,	6 0 ,,	2·28
,,	,,	Bushmills	55 13 ,,	6 31 ,,	1·87
,,	Donegal	Buncrana, Rockfort	55 10 N.	7 26′ W.	2·07

LATITUDES AND LONGITUDES OF THE 50 REGULAR STATIONS.

Div.	COUNTY.	STATION.	Latitude.	Longitude.
I.	Middlesex	London, Camden Square	51° 33′ N.	0° 8′ W.
II.	Kent	Maidstone, Hunton Court	51 13 „	0 28 E.
„	Hampshire	Selborne, The Wakes	51 6 „	0 56 W.
III.	Hertford	Hitchin	51 57 „	0 17 W.
„	Oxford	Banbury, High Street	52 4 „	1 20 W.
IV.	Suffolk	Bury St. Edmunds, Culford	52 18 „	0 42 E.
„	Norfolk	Sprowston, Oak Lodge	52 40 „	1 20 E.
V.	Dorset	Bridport	50 44 „	2 46 W.
„	Devon	Barnstaple	51 5 „	4 3 „
„	Cornwall	Bodmin, Castle Street	50 28 „	4 43 „
VI.	Gloucester	Cirencester, The Firs	51 43 „	1 58 „
„	Shropshire	Shifnal, Haughton Hall	52 40 „	2 23 „
„	Worcester	Tenbury, Orleton	52 18 „	2 26 „
VII.	Leicester	Leicester, Town Museum	52 38 „	1 8 „
„	Lincoln	Boston	52 59 „	0 1 „
„	„	Ulceby, Killingholme	53 39 „	0 16 „
„	Notts	Mansfield, Grove House	53 9 „	1 12 „
VIII.	Lancashire	Manchester, Ardwick	53 28 „	2 13 „
IX.	York	York, Bootham	53 58 „	1 5 „
„	„	Arncliffe	54 9 „	2 6 „
X.	Northumberland	North Shields	55 0 „	1 26 „
„	Cumberland	Seathwaite	54 30 „	3 12 „
XI.	Glamorgan	Cardiff, Crockherbtown	51 29 „	3 10 „
„	Pembroke	Haverfordwest, High Street	51 48 „	4 58 „
„	Merioneth	Aberdovey	52 33 „	4 2 „
„	Carnarvon	Llandudno, Warwick Ho.	53 20 „	3 50 „
XII.	Kirkcudbright	Cargen, Dumfries	55 2 „	3 37 „
„	Roxburgh	Hawick, Silverbut Hall	55 26 „	2 46 „
XIV.	Ayr	Kilmarnock, Annanhill	55 38 „	4 30 „
XV.	Argyll	Lochgilphead, Kilmory	56 2 „	3 23 „
„	„	Mull, Quinish	56 38 „	6 13 „
XVI.	Kinross	Loch Leven Sluice	56 11 „	3 19 „
„	Perth	Tyndrum, Ewick	56 25 „	4 43 „
„	Forfar	Arbroath	56 34 „	2 34 „
XVII.	Aberdeen	Braemar	57 0 „	3 25 „
„	„	Aberdeen, Bonaccord Street	57 9 „	2 6 „
XVIII.	Inverness	Skye, Portree	57 24 „	6 13 „
„	„	Inverness, Culloden House	57 30 „	4 9 „
XIX.	Sutherland	Golspie, Dunrobin Castle	57 59 „	3 56 „
„	Orkney	Pomona, Sandwick	59 3 „	3 20 „
XX.	Cork	Cork, Queen's College	51 54 „	8 30 „
„	Kerry	Caherciveen, Darrynane Abbey.	51 45 „	10 5 „
„	Waterford	Waterford, Newtown	52 12 „	7 0 „
„	Tipperary	Ballina [Killaloe]	52 48 „	8 26 „
XXI.	King's County	Portarlington	53 8 „	7 10 „
„	Dublin	Monkstown, Easton Lodge	53 17 „	6 10 „
XXII.	Galway	Galway, Queen's College	53 17 „	9 3 „
XXIII.	Down	Waringstown	54 25 „	6 16 „
„	Tyrone	Omagh, Edenfell	54 35 „	7 17 „
„	Donegal	Ballyshannon	54 30 N.	8 12 W.

JANUARY, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	2·87	+ ·92	1·12	1	12	51·0	1	19·2	12	27	27
II.		Maidstone (Hunton Court)	2·40	+ ·36	1·15	1	8	...	...	...	...	...	...
,,		Selborne (The Wakes)	4·42	+ 1·15	1·24	2	14	50·0	1	15·0	10	27	30
III.		Hitchen	2·57	+ ·43	1·00	1	15	44·0	1	17·0	5‡	29	31
,,		Banbury	2·37	+ ·28	·50	1	9	45·5	1	15·5	6	29	...
IV.		Bury St. Edmunds (Culford)	1·57	— ·30	·60	2	11	44·0	1	17·0	10	29	30
,,		Norwich (Sprowston)	...	...	...	...	...	...	...	...	...	...	...
V.		Bridport	4·97	+ 1·78	1·21	1	10	...	...	...	...	...	...
,,		Barnstaple	4·04	+ ·52	·79	2	12	54·0	1	18·0	12	...	...
,,		Bodmin	6·55	+ 1·36	1·11	2	16	52·0	1	15·0	12	21	28
VI.		Cirencester	3·65	+ ·65	1·17	1	12	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	1·64	— ·26	·42	17	8	48·0	1	16·0	12	30	30
,,		Tenbury (Orleton)	2·31	— ·22	·54	17	10	49·5	13	10·0	12	29	30
VII.		Leicester (Town Museum)	1·33	...	·29	14	11	50·6	1	17·0	11	28	31
,,		Boston	·92	— 7·9	·52	14	4	42·0	15	19·0	4	26	...
,,		Grimsby (Killingholme)	·91	...	·41	14	15	43·0	14	25·5	6	22	...
,,		Mansfield	1·64	...	·43	14	10	49·4	1	8·8	11	26	26
VIII.		Manchester (Ardwick)	1·64	— ·58	·40	13	6	45·0	13†	16·0	5	29	...
IX.		York	1·05	— ·53	·52	14	...	42·0	1	23·0	...	...	...
,,		Skipton (Arncliffe)	1·34	— 4·30	·52	16	7	...	...	...	..	...	...
X.		North Shields	1·29	— ·82	·25	11*	14	42·2	13	14·5	27	25	25
,,		Borrowdale (Seathwaite)	3·34	—13·02	1·52	12	6	...	...	...	...	..	...
XI.	WALES.	Cardiff (Crockherbtown)	4·71	...	1·30	1	10	49·3	14	17·6	12	25	...
,,		Haverfordwest	4·67	— ·38	·94	17	12	50·0	14	14·0	11	26	27
,,		Aberdovey	1·55	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	·82	— 1·72	·26	17	9	49·7	13	19·1	11	24	...
XII.	SCOTLAND.	Cargen	1·92	— 2·77	·86	12	4	49·3	1	18·0	12§	27	...
,,		Hawick (Silverbut Hall)	·89	...	·30	12	8	...	...	..	...	...	...
XIV.		Annanhill	1·66	...	·86	12	9	40·2	29	19·0	12	28	31
XVI.		Kilmory	2·41	...	1·23	12	11	...	...	15·0	12	27	...
,,		Mull (Quinish)	1·29	...	·65	12	6	43·0	14	28·0	8	6	...
,,		Loch Leven	...	...	...	...	...	...	...	...	...	...	...
,,		Tyndrum (Ewick)	...	...	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	1·92	— ·60	·35	12	10	43·0	14	19·0	3	20	...
,,		Braemar	·65	— 2·48	·08	7	15	41·0	15	3·0	12	29	31
XVIII		Aberdeen	...	...	...	...	...	...	...	...	...	...	...
,,		Portree	1·96	—11·13	·37	14	16	...	...	...	...	...	...
,,		Inverness (Culloden)	·53	— 1·75	...	...	12	44·9	14	19·9	3	20	31
XIX.		Dunrobin	1·51	— 1·14	·50	3	12	45·0	13	19·8	3	20	...
,,		Sandwick	2·36	— ·93	·39	3,12	18	43·5	15	15·4	3	13	25
XX.	IRELAND.	Cork	6·51	...	·70	19	17	...	...	...	...	...	...
,,		Caherciveen Darrynane Abbey	9·05	...	2·90	19	21	...	...	...	...	...	...
,,		Waterford	5·05	+ ·19	·88	17	16	53·0	1	20·0	11*	20	...
,,		Killaloe	2·73	— 2·13	·61	12	10	52·0	18	17·0	2,12	22	...
XXI.		Portarlington	2·44	— 1·57	·46	17	17	51·0	1	19·0	23	22	...
,,		Monkstown, Dublin	2·44	— ·95	·81	7	10	...	...	...	...	...	...
XXII.		Galway	3·74	..	1·00	19	17	52·0	13	21·0	25	20	...
XXIII		Waringstown	2·32	...	·85	17	13	50·0	14	14·0	11	28	28
,,		Edenfel (Omagh)	1·87	...	·56	17	7	45·0	13	15·0	22	29	...
,,		Ballyshannon	...	...	...	...	...	...	...	...	...	...	...

* And 12. † And 14. ‡ And 10, 11. § And 20, 27.

\+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON JANUARY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

HITCHEN.—A very sunless month, with constant N. and E. winds. Highest barometer since March, 1878, and not a glimpse of sun for ten days.

BANBURY.—High wind on 6th, 7th and 12th; S on nine days.

CULFORD.—An exceedingly cold month, the average temp. being only 30°·9. Polar winds prevailed during twenty-one days, and the earth has now (Feb. 1st) been frost bound for more than two months.

BODMIN.—Average temp. of the month 35°·7. On the 23rd the grass min. fell to 9°, the lowest temp. I have registered during thirty years.

SHIFNAL.—Ground covered with S throughout the month (except from 14th to 17th), but never more than 3 in. deep. Frost nightly after the 1st; ice 8 in. thick. Slight, but bitter, winds, chiefly from N. and N.E., accompanied by mist; sun scarcely visible throughout. Birds sadly famished, unless fed; starlings and throstles all gone; blackbirds remain. The Severn, at Shrewsbury, frozen, and will bear.

ORLETON.—A singularly cold month, with very persistent frost. The wind generally from N. and E., and the sky rarely clear. For the last eight days a thick veil of cloud covered the sky, without any break day or night, accompanied by a strong, dry wind. Mean temp. nearly 8½° below the average, and lower than that of any month I have registered. A bright solar halo on the morning of the 1st.

BOSTON.—Temp. 6° below the average. Prevailing winds N.E., and the weather very cold. On the 13th a rapid thaw set in, accompanied by S and R, the temp. suddenly rising 16°, but on the 16th it fell again below freezing point, and continued so to the end of the month.

GRIMSBY.—A month of almost unbroken frost, with very little sunshine, but the cold not severe.

MANCHESTER.—The month may be characterised as one of a good old-fashioned winter, and the delight of skaters; the frost continued, with scarcely any intermission, and S lay on the ground the whole month. The min temp. was below freezing every night but one, and the max. was also low, except for a few days in the middle of the month, when it rose to above 40°.

WALES.

HAVERFORDWEST.—During the first three days a considerable fall of S. Severe E. gale on 7th and 8th, with more S; the E. wind continued, with a black frost, till 13th, when a sudden and rapid thaw took glace, with a considerable fall of R, which caused heavy floods. Frost returned on the 15th, and continued, almost without intermission, to the end of the month; the day temperatures of the last twelve days being uniformly low. The most persistent frost during the last twenty-five years, although the min. temperatures were not very low.

LLANDUDNO.—A dry, cold and comparatively sunless month, almost a continuous frost. The coldest January since observations were commenced in 1860. Mean temp. 34°·0.

SCOTLAND.

HAWICK.—Such a lengthened period of frost and S has not been experienced here since 1837. The wind and consequent snow drifts were not severe, but the long continued S has been very disastrous to the feathered tribes. All out-door labour has been suspended for about eight weeks.

BRAEMAR.—A month of continuous frost and S.

PORTREE.—The coldest January on record, almost continuous S and frost. Such frost and S was never known before in Skye. Sheep suffering greatly on the pastures. Distant T and L on 13th, from 6 a.m. to 3 p.m.

DUNROBIN.—Outdoor operations very much retarded by the continued S. By the end of the month, sunny places, near the sea, were clear of S, but everywhere inland it lies to a considerable depth, without a break. Sheep farmers are incurring great expense, hand-feeding their flocks, as all herbage and heather have been covered up by S since the beginning of December.

SANDWICK.—January has been remarkably cold. During most of it there was a continuance of the frost and S which began on November 23rd, and has been of unprecedented duration; there were, indeed, partial thaws when the wind became westerly, but it was not until the 27th, when the wind was W.S.W. that the thaw approached completeness, though there was still frost at night. There were gales of wind from 50 to 60 miles per hour on five different occasions. One flash of L was seen on the night of the 27th.

IRELAND.

DARRYNANE.—The wettest January registered in ten years, but the number of wet days was below the average. Of the total fall, more than half fell on four days. A very changeable month; one day soft and summerlike, the next dry and bitterly cold, and the next wet, was the rule, until the last ten days, which were dry, but otherwise like the others, changeable.

KILLALOE.—Very low temp. during the month, the mean temp. being 34°·9. Sharp frosts on twenty-two nights, with many bright and agreeable days. Scarcely any fog or mist. Heavy gale, from E. and S.E., on the last three days.

WARINGSTOWN.—Frost continuous, with the exception of three days. Latter part of month bitterly cold E. wind.

EDENFEL, OMAGH.—The frost, which settled upon us in the beginning of December, continued throughout this month, with little intermission, but with somewhat diminished intensity; occasional rapid thaws broke up the rivers, but as rapid returns to frost, leaves the ice still of immense thickness on the lakes, where there has been continuous skating for two months. Altogether the frost has been the most severe and prolonged in the memory of the oldest inhabitant.

THE WEATHER IN JANUARY.

DURING the last three days of 1878, pressure was lowest to the westward or northward of these Islands, and high in the S. of France. S.W. to W. breezes prevailed, bringing dull rainy weather to almost all districts, with high temperatures, the maximum temperatures at Roche's Point and Cambridge being as high as 59°. On the 1st January the first sign of a change occurred; the barometer, after rising quickly over these Islands, began to fall in the S.W., and a well-marked depression advanced to our shores. This disturbance passed in an easterly and south-easterly direction right over the S. of England and the Channel, and was shown on the morning of the 2nd over the N.E. of France. In the rear of this depression the barometer rose briskly with a N. breeze, very fine weather and a sharp frost. On the afternoon of the 2nd a new disturbance appeared in the S.W., and following the same course as its immediate predecessor gave first S. and then E. to N. breezes, the weather being dull, damp, and raw. On the 4th (by which time the depression had passed on to Denmark, while a third had advanced to Brittany), the barometer rose generally; an anti-cyclone was shown over Ireland, and fine, cold weather prevailed.

During the next period (5th–11th) the barometer showed some important oscillations. At first readings were highest over France, whence an arm of high pressure extended northwards over England to our N.W. coasts, com-

paratively low readings being shown to the S.W. of Ireland and over the Baltic, southerly breezes and warm weather consequently prevailed in the W., and N.W. breezes and low temperatures in the E. During the 6th pressure increased briskly over Scandinavia, while a fall of the barometer began on our W. coasts, and extended eastward. These changes continuing the charts of the following day (7th) showed a large anti-cyclone on the eastern shores of the North Sea, and a deep depression off our western coasts, causing fresh to very severe S.E. to S. gales nearly everywhere. The next day the lowest pressures were shown near the mouth of the Channel, whence they afterwards passed very quickly in a south-easterly direction across France, the wind simultaneously backing to the E., still blowing a gale. In the course of the following night a very rapid recovery occurred in the barometer in the S.W., but early on the morning of the 9th a fresh fall began at Valentia, and a new and serious disturbance advanced, taking the same direction as the former one. Severe S.E. to E. gales were experienced in the W. and S.W., through this and the following day. The temperature was low all the week, and sharp frosts prevailed over England. The sea was rough on most coasts; snow fell frequently, but not very heavily, and a good deal of rain in the S.W.

The weather during the following week (12th-18th) was subject to considerable changes. On the 13th and 14th depressions continued to pass northward, or N.N.E., along our western coasts, and S. to S.W. winds prevailed generally, rising on some occasions to the force of a gale, with comparatively warm weather. On the 15th the motion of this area of low pressure suddenly changed to a S.E. direction, from our N. coasts, over the North Sea, towards N. Germany, the wind veered towards W. and N.W., and temperature fell. On the 16th a deep depression advanced to our S.W. coasts; pressure rose over the northern parts of Western Europe, and E. winds, with cold weather, prevailed all day. This depression also moved south-eastwards. On the 17th another change began; a small anti-cylone was formed over Eastern England, occasioning fog and frost, while a fresh disturbance, approaching our western coasts, occasioning southerly winds and higher temperatures, and travelling in a N.N.E. direction. This change eventually spread eastward and northward, and on the evening of the 17th and 18th S. to S.S.E. winds were reported, while a slight thaw set in over the country, accompanied by heavy sleet and snow.

At the beginning of this week (19th-25th) an anti-cyclone was shown on the eastern shores of the North Sea, while an area of low pressure, occasioning a brisk fall of the bar., was advancing to our S.W. coasts. On the 21st the bar. fell briskly over France; the lowest readings were reported from the Bay of Biscay, while pressure was very high, and still rising, over Scandinavia. These conditions caused general easterly winds, and continued, with slight modifications, until the 23rd. On that day, and till the end of the week, a tongue of high pressure extended W.S.W., from the anti-cyclone over Scandinavia, across the North Sea and the British Isles, occasioning the appearance of W. winds in Scotland, with a continuation of the E. breezes in the south. Temperature was below the average, for the time of year, throughout the week. The weather was for the most part dry.

On the 27th a decided rise of the barometer took place over the whole of our Islands, and a band of high readings lay from W.N.W. to E.N.E. across Ireland and N. England, North Sea and the south part of Scandinavia. Atmospheric pressure from this day till the 31st continued high with very little variation, while gradients were nowhere steep. Temperature changed irregularly, and severe frost prevailed on the 26th, 27th, and 28th. The weather was dry and gloomy, except on the 30th, when slight rain, hail or snow was reported from the N. and E. of Scotland and N.E. of England and Ireland. H. E. M.

LIST OF PUBLICATIONS ISSUED BY MR. SYMONS.

* Indicates that no copies remain in stock.

No.	AUTHOR.	TITLE.	Place.	Date.	Size.	Pp.
1	*Symons, G. J.	Barometrical Depression, December 23-27, 1859	London	1859	4to.	1
2	Symons, G. J.	Barometrical Depression, December 23-27, 1860	London	1860	4to.	2
3	*Symons, G. J.	Notes on the Solar Eclipse of 18th July, 1860	London	1860	8vo.	26
4	*Symons, G. J.	English Rainfall, 1860	London	1861	4to.	4
5	*Symons, G. J.	British Rainfall, 1860-1861	London	1862	8vo.	18
6	*Symons, G. J.	On the Rainfall of the British Isles, 1860-1-2 ... (*Ext.*)	London	1863	8vo.	8
7	*Symons, G. J.	British Rainfall, 1862	London	1863	8vo.	25
8	*Symons, G. J.	On the fall of Rain in the British Isles, 1860-61...(*Ext.*)	London	1863	8vo.	70
9	Symons, G. J.	British Rainfall, 1863	London	1864	8vo.	48
10	*Symons, G. J.	On the Fall of Rain in the British Isles, 1862-63 (*Ext.*)	London	1865	8vo.	40
11	*Symons, G. J.	British Rainfall, 1864	London	1865	8vo.	80
12	Symons, G. J.	Outline Sketch of Rainfall Investigations, 1677-1865 (*Ext.*)	London	1866	8vo.	51
13	Symons, G. J.	British Rainfall, 1865	London	1866	8vo.	117
14	Symons, G. J.	On the Progress of Rainfall Investigations and Fluctuations in the Annual Fall of Rain ..... (*Ext.*)	London	1866	8vo.	15
15	Symons, G. J.	Monthly Meteorological Magazine, Vol. I.	London	1866	8vo.	110
16	Symons, G. J.	British Rainfall, 1866.....	London	1867	8vo.	116
17	Symons, G. J.	Monthly Meteorological Magazine, Vol. II.	London	1867	8vo.	146
18	Symons, G. J.	Report of Rainfall Committee, 1865-66 .....(*Ext.*)	London	1867	8vo.	70
19	Symons, G. J.	Rain: How, When, Where and Why it is Measured ...	London	1867	sm. 8vo.	88
20	Symons, G. J.	British Rainfall, 1867	London	1868	8vo.	125
21	Symons, G. J.	Report of Rainfall Committee, 1866-67.....(*Ext.*)	London	1868	8vo.	20
22	Symons, G. J.	Monthly Meteorological Magazine, Vol. III.	London	1868	8vo.	204
23	Symons, G. J.	British Rainfall, 1868	London	1869	8vo.	144
24	Symons, G. J.	Report of Rainfall Committee, 1867-68.....(*Ext.*)	London	1869	8vo.	43
25	Symons, G. J.	Monthly Meteorological Magazine, Vol. IV.	London	1869	8vo.	200
26	Symons, G. J.	British Rainfall, 1869	London	1870	8vo.	176
27	Symons, G. J.	Report of Rainfall Committee, 1868-69.....(*Ext.*)	London	1870	8vo.	21
28	Symons, G. J.	Monthly Meteorological Magazine, Vol. V.	London	1870	8vo.	220
29	Symons, G. J.	British Rainfall, 1870	London	1871	8vo.	184
30	Symons, G. J.	Report of Rainfall Committee, 1869-70.....(*Ext.*)	London	1871	8vo.	60
31	Symons, G. J.	Monthly Meteorological Magazine, Vol. VI.	London	1871	8vo.	232
32	Symons, G. J.	British Rainfall, 1871	London	1872	8vo.	206
33	Symons, G. J.	Report of Rainfall Committee, 1870-71.....(*Ext.*)	London	1872	8vo.	19
34	Symons, G. J.	Monthly Meteorological Magazine, Vol. VII.	London	1872	8vo.	220
35	Symons, G. J.	British Rainfall, 1872	London	1873	8vo.	208
36	Symons, G. J.	Report of Rainfall Committee, 1871-72.....(*Ext.*)	London	1873	8vo.	33
37	Symons, G. J.	Monthly Meteorological Magazine, Vol. VIII.	London	1873	8vo.	196
38	Symons, G. J.	British Rainfall, 1873	London	1874	8vo.	200
39	Symons, G. J.	On the Sensitiveness of Thermometers .....(*Ext.*)	London	1874	8vo.	7
40	Symons, G. J.	Report of Rainfall Committee, 1872-73.....(*Ext.*)	London	1874	8vo.	47
41	Symons, G. J.	Monthly Meteorological Magazine, Vol. IX.	London	1874	8vo.	192
42	Symons, G. J.	British Rainfall, 1874	London	1875	8vo.	214
43	Symons, G. J.	On a White Rain or Fog Bow.....(*Ext.*)	London	1875	8vo.	8
44	Symons, G. J.	Report of Rainfall Committee, 1873-74.....(*Ext.*)	London	1875	8vo.	43
45	Symons, G. J.	Monthly Meteorological Magazine, Vol. X.	London	1875	8vo.	196
46	Symons, G. J.	British Rainfall, 1875.....	London	1876	8vo.	216
47	Symons, G. J.	On the Floods in England and Wales during 1875, and on Water Economy.....(*Ext.*)	London	1876	8vo.	20
48	Symons, G. J.	Monthly Meteorological Magazine, Vol. XI.	London	1876	8vo.	184
49	*Symons, G. J.	Pocket Altitude Tables, short and simple rules for accurately determining Altitudes barometrically.....	London	1876	32mo.	32
50	Symons, G. J.	Report of Rainfall Committee, 1874-75	London	1876	8vo.	21
51	Symons, G. J.	Abstract of Meteorological Observations made at the Gardens of the Royal Botanic Society, 1871-1876... (*Ext.*)	London	1877	8vo.	24
52	Symons, G. J.	British Rainfall, 1876	London	1877	8vo.	224
53	Symons, G. J.	Monthly Meteorological Magazine, Vol. XII.	London	1877	8vo.	192
54	*Symons, G. J.	Rainfall, and its Relation to Civilized Life ..... (*Ext.*)	London	1877	8vo.	26
55	Symons, G. J.	Report of Rainfall Committee, 1875-76..... .....(*Ext.*)	London	1877	8vo.	32
56	Symons, G. J.	Pocket Altitude Tables, (2nd Edition).....	London	1877	32mo.	40
57	Symons, G. J.	Improved Form of Thermometer for Observing Earth Temperature.....(*Ext.*)	London	1877	8vo.	8
58	*Symons, G. J.	The Climates of the various British Colonies .....(*Ext.*)	London	1877	8vo.	33
59	*Symons, G. J.	Supply and Storage of Water ....(*Ext.*)	London	1877	8vo.	8
60	Symons, G. J.	British Rainfall, 1877	London	1878	8vo.	208
61	Symons, G. J.	Monthly Meteorological Magazine, Vol. XIII.	London	1878	8vo.	188

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLVIII.] MARCH, 1879. [PRICE FOURPENCE or 5s. per ann. post free.

METEOROLOGICAL BIBLIOGRAPHY.

THIS subject is not altogether new to our readers, for although we have never devoted a special article to it, many direct expressions in support of it will be found scattered through our 157 issues, as we have ourselves, during the past 15 years, compiled for our own use a catalogue containing upwards of 10,000 titles of separate works upon Astronomy, Meteorology, and Terrestrial Magnetism. If we assume that two-thirds of these are astronomical, it still leaves more than 3,000 separate titles for individual meteorological and magnetical works.

This month we intended to make it the leading topic, in the hope that at the forthcoming Congress at Rome it might be fresh in the minds of the delegates, and that perhaps something might be done.

While arranging the materials upon which to base our appeal, the March number of our excellent contemporary, Dr. Hann's *Zeitschrift*, arrived, and therein we found an article by Dr. Hellmann, of Berlin, embodying almost exactly the views we were about to express. Although this necessarily involved an entirely different mode of treatment of the subject, we are extremely glad of the coincidence, because it not only proves that Dr. Hellmann shares our views as to the necessity of something being done, but it also implies that the Editor, Dr. Hann, does so too.

In these circumstances, we think that the best course is to print a translation of Dr. Hellmann's article, and then to conclude with some remarks embodying our own experience : these will be found on page 20.

ON THE PUBLICATION OF A METEOROLOGICAL BIBLIOGRAPHY.

BY DR. G. HELLMANN, OF BERLIN.

Paragraph 9 of the Joint Programme for the second International Meteoro logical Congress to be held in Rome in April, issued by the Permanent Committee at its last sitting at Utrecht in October, 1878, says : "The Committee proposes to have prepared at the general expense a catalogue of the published and unpublished meteorological observations of all countries." In addition to this proposition, to which individual central institutions have responded, I take the liberty of submitting to the Congress a second, no less important, and

which to some extent includes the former—to have published at the general expense a systematic catalogue of the books, pamphlets, and treatises referring to meteorology and terrestrial magnetism.*

Everyone who has elaborated or written a treatise must have felt the urgent necessity of becoming acquainted with all the existing literature on the subject to which it refers, in order not to repeat what has already been said about it, and for the purpose of comparing his own results with those of others, whereby in many cases he might be led to modify the whole of his work. The resources of meteorology available for such purposes have hitherto been quite insignificant and imperfect, and everyone must often have found that, after publication, he becomes quite accidentally aware of the existence of works treating of the same subject. According to the scientific character of individuals, as of whole nations, will the effort to become acquainted with the works of others in the same field of labour be necessarily very diverse; indeed, it may be said to be a characteristic of certain races to leave wholly unrecognised all thereto referring literature, especially if foreign—a circumstance which explains the frequently-recurring fact that things are published as new discoveries and results, which have long been known and commonly discussed elsewhere. It is also my belief that the necessity for a Meteorological Bibliography is one universally felt, and that the publication of such a work would indirectly tend to promote the advancement of science. The idea of such an undertaking in kindred branches of science is by no means new, for the very reason that its necessity is one which, in regard to a literature at all copious, has always been felt to be undeniable. As early as the end of the last century, Reuss wrote a universal Bibliography; La Lande his celebrated "Bibliographie Astronomique," &c., &c.; and in the present century such publications have been so frequent that their bare enumeration would occupy several pages. In the field of meteorology, as in that of terrestrial magnetism, nothing of this kind has as yet appeared. That the "Société Météorologique de France," once entertained a similar idea is to be gathered from the minutes of its former sittings; but it was never carried into execution for want of funds.†

Although the publication of a systematic catalogue of the Meteorological Libraries would be a great step in advance in this direction, the *Meteorological Society* has alone the merit of having published such a work.‡ But even if the central institutions of Vienna, St. Petersburgh, Hamburgh (the former "Dove" library), London, and Utrecht, which possess extensive special libraries, were to do the same, the requirement of a meteorological bibliography would by no means be met thereby, as none of them is so perfect, as—for example, in reference to astronomical subjects—that of the Observatory in Pulkowa, the catalogue§ of which affords the advantages of a universal astronomical bibliography.

The work would have to be begun over again, and made as comprehensive as possible, so that we might derive the full benefit of such an undertaking. Hence I consider the International Meteorological Congress best adapted for carrying such a task into execution at the general expense.

We must distinguish between separately published books and pamphlets on the one hand, and the much more numerous notices and observations in periodicals and the papers of learned societies on the other hand. The latter

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* As both sciences will long continue to go as they have hitherto done, hand-in-hand, it is strongly advised that the works on terrestrial magnetism be included.

† Mr. Symons, of London, is, to my knowledge, diligently engaged in the collection of Bibliographical Notices on the subject of Meteorology. Mr. Cleveland Abbe, of Washington, has recently addressed to the Editor of this journal, among others, the following lines:—"Do you know of any one who is interested in or compiling a general Bibliography of Meteorology? I have begun one by copying and classifying about 23,000 titles from the Royal Society Index, Vol. I.—IV., which I estimate to be one-third of my work."

‡ From Brussels one may soon be expected. That compiled by Herr Kiefer, of the Tiflis Observatory, is unfortunately not systematically arranged, and consequently of little practical utility.

§ First edition, by W. Struve, in 1845; second, by O. Struve, in 1860; continuation to 1875 in the press.

are far more important, and the task of collecting them is by far the most difficult. In this respect, however, the chief part of the task for the present century has been performed for us by the publication of the Catalogue of scientific papers (1800–1863), compiled and published by the Royal Society of London, Vol. I.–IV. (1867–72), and the continuation of which for the period 1864–1873 (the first part A to H already published) is still in the press.

This universally known and valued catalogue contains, it may be stated, in alphabetical order of the authors' names,* as well as the titles of all treatises, papers, and dissertations, which have appeared in the domain of the exact and natural sciences during the present century.† The systematic "extraction" of these eight quarto volumes of about 8,000 pages would constitute the chief labour. For the preceding century the same course would have to be pursued with individual *special journals* and minutes of academy proceedings, a task of course of much smaller importance, as it is only during the present century that meteorological science has become independent, and consequently more productive. For the part borne by the larger books, pamphlets, &c., in the last and preceding centuries, the already existing bibliographies, notably those of Astronomy as the mother of Meteorology, suffice, and likewise Poggendorf 's "Biographical Literary Dictionary." In the present century the yearly catalogues of the book trade amply supply the necessary material. In any case it would be advisable in the publication of such a work to secure the co-operation of experienced booksellers and antiquaries.

The process of "extraction" of the "Royal Society Catalogue" I presume to be simply that a person versed in the subject, capable of taking a general view of the whole domain, and possessing at the same time the requisite knowledge of languages, should examine page by page each individual volume, and mark with a red pencil the titles which refer to the special science. Then several careful copyists make copies of the said marked titles just as they stand in the catalogue, upon previously prepared cardboard tickets, about 3 by $4\frac{1}{2}$ inches in size, which finally are systematically arranged with the others. A certain limitation of the domain and of the mode of procedure in cataloguing would of course be necessary, although it would be better to err on the side of excess rather than that of scantiness. The corresponding task for previous centuries would be greatly simplified if the directors of the various central institutions would undertake the preparation of the ticket catalogue for their respective countries, as they would have the readiest access to the necessary documents.

Within three years the catalogue could be ready for the Press. According to the bulk of the catalogues of the "Royal Society" and that of the Pulkowa Library, it would make a quarto volume of about 800 pages. The countries interested, through whose pecuniary and intellectual assistance it had been published, would, of course, be entitled to a certain number of copies free of cost. The remaining copies might, like those of the Roy. Soc. Cat., be sold at cost price. The sum realised by the sale could be applied to the furtherance of the undertaking, as about every 10 years a continuation of the Bibliography should appear. The difference of languages need occasion no difficulty, as the brief introduction and headings could be given in the three principal languages or in Latin. I should estimate the probable cost at about 30,000 marks, so that the participation in the undertaking of Europe, America, and India being presupposed, the proportion of expense to each of the 24 states would be a sum of 1,250 marks—£62 5s. 0d.—1,563 francs. Any further detailed statement of

* Treatises written in Russian appear to be wholly wanting. They are as yet a vanishing fraction as compared with the literature of the nations of the Germanic and Romanic dialects.

† It is not, however, to be wholly depended upon. It was not, for instance, possible to find in this catalogue that Bravais and Martins published their hourly observations on the Faulhorn, 1841, 1842, and 1844, in the second year's issue of *L'Annuaire de la Soc. Météor. de la France*, and in like manner no mention is made of Carlos Aquirres' meteorological observations at Antisana, according to the report in the *Comptes rendus*. Kämtz's Repertorium is also not mentioned. These omissions I have only accidentally discovered during the last few months that I have had the book in my possession.—*J. Hann.*

the undertaking, as of the joint international action in the matter, must necessarily be reserved for a commission of the Congress appointed *ad hoc.**

In the first place it is necessary to consider what is desirable, and what is possible.

It would be a priceless boon to investigators if they could have a *classified index* of every notice of a meteorological phenomenon or investigation. It would save much time and much labour. We may give an illustration which has occurred within the last few months.

About two years ago, Mr. Dines, whose house at Hersham has a tall square tower, placed at one corner of it a rain gauge. Then he thought it would be interesting to see whether the fall at each corner of the tower was similar and bore the same ratio to that on the ground. He procured extra gauges, observed them for some time, and wrote a description of the results, which was published in *British Rainfall*, 1877. Mr. Rogers Field took up these figures, and in an elaborate letter in this magazine showed that the catch of each gauge depended on the direction of the wind at the time. We followed it with a short note, of which the opening sentence was—

"We think that experiments somewhat resembling those of Mr. Dines, with four gauges at the top of one tower, were tried about twenty years since, either in Denmark or the United States. We have entirely forgotten the results, and have but a very dim recollection of the circumstance; anyone who can give full particulars will be rendering a service to all students of the subject."

Not knowing the author, or the country, the search for the above was sufficiently hopeless, but by chance we have found the full particulars. The experiments were made at Philadelphia, in 1833, by Prof. Bache, and are described in the "Report of the British Association for 1838." They were almost identical with Mr. Dines's (except that Prof. Bache had a much higher tower), and led to the same conclusions.

A classified index would have saved all Mr. Dines's work, and time and thought, Mr. Field's time, and our space, and this of course is but one instance.

A complete subject index would be an enormous work to undertake, but we should be sorry to accept Dr. Hellmann's view that it "must ever remain something to be wished for." It is a curious fact, which is more a problem for physiologists than for ourselves,

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* The view has been propounded to me that a Bibliography would not suffice, and that it should be followed by a Table of Contents of the respective books. It will, however, be evident on consideration that this must ever remain simply something to be wished for; as, apart from the partially impracticable nature of the proposition, that it would demand altogether unreasonable sacrifices, both in intellectual labour and material resources. On the other hand, the same object could in future be obtained by an annual issue of a "Report of the progress of Meteorology and Magnetism during the year ——," in which every paper would be analysed as minutely as possible. The publication of such a report would be a fitting task for the contemplated "International Bureau," to which, for that purpose, everything written on the subject would have to be sent, as would willingly be done by everyone.

that nineteen men out of twenty who take up meteorology decline to study the subject, and immediately begin to make a lot of fresh observations. And most unfortunately this weakness in the individual human brain extends to the directors of our national systems, who nearly all seem to consider the erection of costly recording apparatus, and the publication of hourly values, the end and gaol of their responsibilities. But surely it is of little use making observations if they are not fully discussed, and can they be fully discussed without perfect knowledge of what our predecessors have done, and what our contemporaries are doing?

It is the old, old story; it is one more sermon upon the words, "The observing is out of all proportion to the thinking strength in Meteorology."

Several separate attempts at forming such a classified index have been made. Prof. Poey has many thousand entries, Prof. Cleveland Abbe (ante p. 18) has 23,000, and lastly, in the *Athenæum*, of March 16th, 1879, we find the following:—

> At the meeting of the Library Association on Friday, the 7th inst., Mr. Garnett read a paper on "Subject-Indexes to the Transactions of Learned Societies," in which he pointed out that by the sacrifice of two, or at most three, copies of the Royal Society's Catalogue of Transactions, a series of slips can be easily made, which, after a rough classification, might be submitted to competent men of science for accurate and minute subdivision. The classes, when completed, should be printed in separate volumes, so that every student and specialist might obtain his own subject on moderate terms. The work might thus be made remunerative, and the Association would distinguish itself by undertaking the publication.

If any difficulty is raised on the score of cost, we do hope that some German statist will ascertain the total amount annually spent in the world upon the making and printing of meteorological observations, so that we may be able to compare the amount spent upon the observing, and upon the thinking, branches of meteorology.

We must, however, take both things and men as we find them, and the question remains not what is theoretically desirable, but what is practicable and expedient.

Having had the privilege of assisting in compiling the catalogue which alone meets Dr. Hellmann's approval, and having the materials for a far better one in MS. on our own shelves, we are tolerably familiar with the subject, and our first caution would be, Do not be frightened at its imaginary magnitude.

We think that the first step should be to urge the Director of each Central Institute to print a catalogue of its own library. If they could be induced to do so in duplicate, *i.e.*, both grouped in subjects and under authors, so much the better; but at any rate under subjects. It is difficult to believd that this can be refused. It may also be hoped that the *Société Météorologique de France* and the *Scottish Meteorological Society* will follow the lead of the *Meteorological Society*. The Society of Telegraph Engineers have in the press the catalogue of the celebrated Ronalds Library (Electricity, Magnetism,

and Meteorology). We should thus obtain about a score of catalogues, each very useful in its own country, and collectively containing probably 90 per cent. of the titles of all meteorological works ever written. The compilation from these of one general catalogue of meteorological books and memoirs would be very easy, and the cost insignificant.

Another step which we think would be extremely useful is a development of the rule adopted by the Meteorological Committee, a rule so good that we regret that other national establishments have not copied it. We refer to the practice which Mr. Scott has uniformly followed, of giving, on the cover of each publication issued by his department, a list of all its previous publications. If he would kindly print it as a fly-leaf, which could be cut out and mounted, he would render a further service. The Smithsonian Institution also publish a list, but it is printed on both sides. Authors and directors could easily compile such lists, and if printed only on one side they would, when cut up and mounted, form capital catalogues. We trust that it will not be falsely attributed to vanity that we issue with this article a list of our own publications as a specimen of what we ask for from others.

THE LATE WINTER.

To the Editor of the Meteorological Magazine.

SIR,—I send some results of my thermometrical observations during this extraordinary winter, taken at the Vicarage, 660 feet above sea level :—

	1878.		1879.		Four months
	Nov.	Dec.	Jan.	Feb.	Nov. to Feb.
Extreme max.	47°·6	48°·0	45°·0	47°·3	48°·0
	on 10th.	on 31st.	on 1st.	on 9th.	Dec. 31st.
Ditto in sun	92°·0	88°·0	86°·0	117°·0	117°·0
	on 24th.	on 29th.	on 26th.	on 24th.	Feb. 24th.
Extreme min.	26°·0	7°·2	10°·6	20°·0	7°·2
	on 11th & 21st.	on 13th.	on 27th.	on 23rd & 25th.	Dec. 13th.
Ditto on grass	15°·0	—0°·5	1°·0	13°·0	—0°·5
	on 20th.	on 13th.	on 27th.	on 25th.	Dec. 13th.
Mean temp. of air [9 a.m. & 9 p.m., max. & min.] ...	36°·1	29°·5	28°·7	33°·2	31°·9
Mean daily max. ...	40 ·7	34 ·7	33 ·6	36 ·8	36 ·4
Mean daily min. ...	32 ·0	24 ·1	23 ·9	29 ·6	27 ·4
No. of minima at or below 32°	15	26	30	20	91
Ditto on grass	27	31	31	25	114

Snow fell slightly on 2nd November; on the 5th it snowed on the hills; on the 8th we had a heavy fall here, which proved the commencement of winter, and was followed on the 12th by a snowstorm of great violence, many sheep being "over blown" on the hills.

There was a heavy rainfall on the 15th, but frost and snow soon returned, and continued with intermissions to the 5th December, when severe frost set in, and, with two intermissions (of three last days in December, and 13th and 14th January), continued nine weeks. Our water supply pipe, placed 1 foot under ground, became frozen on the 13th December, and continued frozen till the evening of the 27th February. There was a week of mild weather in February, but from the 13th to the 26th the max. did not exceed 36°, and much snow fell. When the sun came out its glare was almost intolerable, especially on the 24th. There was little snow from the 5th to the 18th December, and none from the 1st to the 11th January. At the middle of January the frost had in many places penetrated 2 feet into the ground. This was ascertained by two hours' digging with a pick. I had holes made with a crowbar on the 13th January, and found the ground soft at the following depths, and placing thermometers in the holes and covering the openings, I found the following temperatures :—

		Air temp.	Loose soil. 20 in.	Garden soil. 17 in.	Upper lawn. 12 in.	Lower lawn. 12 in.	Meadow. 8 in.
Jan.	13	42°	33°·0	33°·5	33°·0	33°·5	33°·8
,,	16	28	32 ·5	33 ·8	33 ·0	33 ·1	33 ·2
,,	17	27	32 ·3	33 ·6	33 ·5	32 ·9	33 ·0
,,	27	25	31 ·7	...	33 ·3	32 ·7	lost under snow.
Feb.	6	39	31 ·6	...	33 ·5	frozen into hole	31 ·5
,,	8	39	31 ·7	32 ·0	33 ·5	ditto	...
,,	10	40	31 ·8	32 ·5	35 ·5	ditto	...
,,	11	38	32 ·0	33 ·0	36 ·5	ditto	...
,,	12	33	31 ·8	32 ·9	35 ·5	ditto	...
,,	13	33	31 ·8	32 ·8	35 ·5	ditto	...
,,	27	40	31 ·9	33 ·5	34 ·0	33 ·7	...
,,	28	40	32 ·0	34 ·5	36 ·5	35 ·0	...
Mar.	1	36	32 ·0	35 ·5	36 ·0	35 ·5	...

On the whole it has been a pleasant winter—December and a part of January being remarkably sunny, and both months dry throughout, but November and February were wet.

At Penrith the mean temp. was as low as 25°·9 in December, and the mean min. for thirteen consecutive days (13th–25th), 8°. The extreme was —2°·5 on December 23rd. Here I observed it 1° in the valley about 9 a.m. on the 13th December, after the ther. had risen 4° from the min. at the Vicarage, and 0° was registered on the 27th January, while an exposed minimum thermometer indicated —7°. The minima in the valley agreed closely with those at Penrith fifty miles off, but were greatly below those at the Vicarage, a quarter of a mile off, but 200 feet higher.

FENWICK W. STOW.

Aysgarth Vicarage, Bedale, March 1st, 1879.

To the Editor of the Meteorological Magazine.

SIR,—Your correspondent, Mr. Bicknell, writing on the severe weather, says, "It will have rid our agriculturalists of many insect pests." I hope it has. There is one very great pest to the agriculturist which it is generally believed the frost kills—and that is the common slug. Nothing can be a greater mistake. This winter, the moment the frost relaxed its hold, I saw the ground—and particularly gravel paths—covered, hundreds, aye, thousands of them, and seemingly nothing the worse for the cold weather.

I confess I hardly know what pests to the farm or garden are destroyed by frost. One thing, everybody will find that a great many valuable shrubs have been destroyed, and among vegetables I never saw such destruction.

Excuse my simply referring to that one article in the *Meteorological Magazine*.—I am, Sir, yours truly,

JOHN MATHISON.

Addington, 18th February, 1879.

THE SHAPE OF RAIN DROPS.

To the Editor of the Meteorological Magazine.

SIR,—In the last number of the *Meteorological Magazine* there is a letter from Mr. Sawyer on the shape of rain-drops, accompanied by what I may perhaps be allowed to call a very remarkable sketch. As the letter only refers to the shape of rain-drops when falling through a calm atmosphere, it is unnecessary to consider the effect of wind, which, however, would, I believe, have no influence on their shape.

In his reasoning Mr. Sawyer apparently does not take into account cohesion, which has more influence on the shape of rain-drops than any other force, and would cause them to become spherical, and as a sphere presents less surface than an equal amount of matter in any other form, and therefore displaces a smaller quantity of air, it is natural to conclude that rain-drops are spherical.

All parts of a drop having an equal tendency to fall, there is no reason to presume that its shape would alter, but if, as suggested, the centre did begin to fall quicker than the sides, it would continue to fall quicker, and would ultimately fall out and form a separate drop. Anyone acquainted with the properties of water would at once see that if it were forced into the shape represented by the middle row of figures in Mr. Sawyer's sketch, cohesion would immediately draw in the ends and the drop become spherical.

As a presumptive proof of the shape of rain-drops, I may instance shot, which assume their form in falling through air, and as lead in a

liquid state bears a close analogy to water, I think we may justly infer that rain-drops are like shot, truly spherical.

I am, Sir, yours faithfully,
H. SOWERBY WALLIS, F.M.S.

1, *Springfield Road, St. John's Wood,*
Feb. 20th, 1879.

To the Editor of the Meteorological Magazine.

SIR,—Mr. F. E. Sawyer does not seem to have remembered that we have in the rainbow a means of learning something of the shape of rain-drops. According to theory, the drops must be spherical to produce a rainbow; and any departure from sphericity, at least in those portions of the drop which are concerned in its production, will render the bow less perfect. Now, the top of a rainbow is always the most definite part, the colours being most often repeated there, although as a rule it is the faintest part. This seems to prove that either the lower drops are less spherical than the upper, or else their vertical sections are more circular than their horizontal. The latter seems very improbable, and therefore we are driven to the former alternative, which appears the more likely when we consider that the upper drops must be smaller than the lower. If we examine the bows in single dew-drops, we find that the smallest drops give, as a rule, the most perfect bows, the solar spectrum frequently being visible 10 or 12 times repeated in them; while in the larger drops there are not so many repetitions, though the bows are very much brighter. I gather from this that the larger drops of dew are less perfectly spherical than the smaller, and therefore it is not surprising that the same should be the case with rain; but that rainbows should be as bright and definite as they are, proves that the irregularities in the majority of the drops must be very slight. The circumstance that the colors are much less often repeated in a rainbow than in a dew-drop (I never saw more than four contiguous spectra in the primary arc of a rainbow), may be an indication that the individual rain-drops deviate in different ways from sphericity, unless it is merely owing to the wideness of the spaces between the drops. These considerations do not at all show what form the irregularities in rain-drops take; I do not know whether any observations have ever been made as to whether rainbows are perfectly circular; this might throw some light on the question.

THOS. WM. BACKHOUSE.

Sunderland, February 21*st,* 1879.

To the Editor of the Meteorological Magazine.

SIR,—Surely Mr. Sawyer must have completely forgotten Newton's second law of motion and the theory of gravitation, when he propounded his extraordinary theory of the shape of rain-drops (*Met. Mag.*, No. CLVII. p. 6), or he would never have assumed that the external particles of a drop would fall faster than those at the centre.

The force of gravity acts equally on all the atoms of water forming the falling drop, producing in each a velocity proportional to the time of its descent, hence there can be no force to oppose that of molecular attraction, which necessarily in the case of fluids must produce spheres. Therefore rain-drops must always possess this form.

The formation of drops under different conditions has already been fully investigated by many physicists—Savart, Matteucci, Plateau and others (v. Daguin, *Traité de Physique*, tome I. chap. 2.) who have proved experimentally that theory is correct, and that drops of all fluids when falling freely are invariably perfect spheres.

A most interesting paper, by Mr. Worthington, on the figures produced by drops striking a flat surface, has recently appeared in the Proceedings of the Royal Society, which is well worthy the perusal of all concerned in the measurement of rainfall.

One word more, as I am much engaged in the application of photography to scientific registration, I should be glad to be referred, if Mr. Sawyer would kindly assist me, to a notice of a photographic process which would enable me to obtain a picture of an object moving at the rate of 150 feet a second, the approximate velocity of a rain-drop fallen from clouds 1000 feet high, on its reaching the earth's surface.

G. M. WHIPPLE.

Richmond, March 6th, 1879.

THE WEATHER IN FEBRUARY.

THE weather during the first week of this month was in a changeable state. A small depression appeared on the S.W. coasts on the morning of the 2nd; the wind became S. in the south, and S.E. to E. in the east and north. Temperature rose quickly in the S., cold rain began to fall, and the frost to disappear. During the 3rd the disturbance passed away south-eastwards over the Channel and France. The wind blew from the E. to N.E. generally, and an area of high pressure was formed on our W. and N. coasts. This anti-cyclone travelled slowly in a S.E. direction during the following day (the temperature falling briskly in the S.E. meanwhile), and was succeeded by a rapid fall of the barometer on our W. and N.W. coasts. The wind at the same time became southerly and increased in force. From this day to the end of the week pressure was highest over France, lowest in the W. and N.W., and numerous depressions passed north-eastwards over or near these Islands, causing fresh to strong S.W. winds or gales on all coasts.

Numerous depressions affected the weather over these Islands and their neighbourhood during the second week. At first the course of these disturbances was from S.W. to N.E., and strong S.W. to W. winds were felt in the south, light E. in the north, the weather at the time being mostly dull, wet, and unsettled. On the 11th, however, a depression passed S.E. from the South of Ireland across the Channel and France, and the wind backed from W. through S. to N., and on the day following the weather improved as the barometer rose. This increase of pressure was of very short duration, for on the evening of the same day (12th) the mercury began to fall in the South-West of Ireland, and on the 13th a fresh and deep depression appeared on our S.W. coasts with strong S. to S.E. winds. This disturbance likewise passed

in a S.E. direction to France, and S.E. winds again became general, with rain in the E. On the 14th the barometer rose, but on the 15th a new depression appeared in the N.W. and travelled across the Irish Sea towards Central England. This fall continued, and became general throughout Western Europe on the 16th and 17th.

During the third week the weather was again very unsettled, though no disturbance bringing general and severe gales approached these Islands. The chief feature of the distribution of pressure was the establishment of regions of high pressure, one over Lapland and over the Peninsula with a "trough" of low readings between them extending from S.W. to N.E. across the British Isles. This distribution was interrupted on the 19th, when the W. to N.W. winds which had prevailed in the S., and E. to S. winds in the north gave place to general W. to S.W. breezes for a while, but on the next day depressions again advanced from N.W. towards S.E., and the former distribution was really re-established and lasted to the close of the week. A brisk rise of the barometer then occurred in the W. and N.W., and pointed to the formation of high pressures to the N. and N.W. of these Islands accompanied by N. winds.

The wind during this week (16th–22nd) was strong at times on most coasts, and on the night of the 20th a severe gale was experienced in the S.W. with thunder, lightning, and hail. The sky was mostly cloudy except over North Britain, and showers of snow and rain fell on all days. The fall of snow in London on the morning of the 21st was exceedingly sudden and heavy, 0·87 in. being measured.

The weather during the last week of February was characterised by a very important change from N.E. winds and cold weather to W. winds and mild weather. On the 23rd readings were highest off the W. coast of Ireland, low over the North Sea, and in the South-East of France, so that N. breezes prevailed generally with cold cloudy weather. On the 23rd and 24th pressure rose decidedly in the N.W. of these Islands; a rather deep depression appeared over the South-East of France, and moved north-eastwards towards Germany and the Baltic, so that the wind veered, and N.E. breezes were reported from most coasts and blew hard in the S.E. The weather was cloudy and unsettled; sharp snow and hail showers occurred in the S.E. On the 26th a fall of the barometer took place in the North of Scotland, so that while N.E. breezes continued in the S., S.W. winds appeared in the N. From this time till the end of the week pressure was high in the S. or S.W., and W. to S.W. winds—for the most part light or moderate in force—prevailed. The weather meanwhile was rendered unsettled by the passage across our Islands of several small local depressions.

At the former part of the month temperature was rather above the average, but as the month advanced it decreased, and during the second week oscillated a good deal. During the third week it was considerably below the average, and the oscillations of the thermometer in the North of Scotland were very curious. Cloudy skies were very general throughout the month, and rain and snow fell on many days.

H. E. M.

SUPPLEMENTARY TABLE OF RAINFALL IN FEB., 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	2·40	XI.	Port Madoc	5·68
,,	Littlehampton	4·19	,,	Douglas.....	4·27
,,	Horsham, Swallowfield.	...	XII.	Carsphairn	3·45
,,	Hastings, Manor House	3·80	,,	Melrose, Abbey Gate...	2·76
,,	Hailsham	4·01	XIV.	Lanark, Baronald	...
,,	I. of W., St. Lawrence.	3·79	XV.	Islay, Gruinart School..	2·74
,,	Strathfield Turgiss	3·07	XVI.	St. Andrew's, Cambo...	2·27
III.	Great Missenden.....	4·27	,,	Aberfeldy H.R.S.	1·41
,,	Winslow, Addington ...	3·10	XVII.	Tomintoul.....	1·64
,,	Oxford, Magdalen Col...	3·08	,,	Keith H.R.S.	·80
,,	Northampton	2·77	,,	Forres H.R.S.	·30
,,	Cambridge, Merton Vil.	2·70	XVIII.	Strome Ferry H.R.S....	2·75
IV.	Harlow, Sheering	3·01	,,	Lochbroom	1·42
,,	Diss	3·13	,,	Auchnasheen H.R.S. ...	·67
,,	Swaffham	2·42	,,	Tain, Springfield.....	·96
,,	Hindringham	2·16	,,	Loch Shiel, Glenfinnan.	4·30
V.	Salisbury, Alderbury...	3·93	,,	Dalwhinnie H.R.S.....	1·99
,,	Calne, Compton Bassett	3·94	XIX.	Lairg H.R.S.	...
,,	Beaminster Vicarage ...	5·51	,,	Altnabreac H.R.S.	1·17
,,	Dartmoor Prison.....	10·29	,,	Watten H.R.S.	1·05
,,	Langtree Wick	5·21	XX.	Fermoy, Glenville	6·45
,,	Lynmouth, Glenthorne.	6·62	,,	Tralee, Godfrey Place...	5·28
,,	St. Austell, Cosgarne...	6·09	,,	Cahir, Tubrid	4·30
,,	Taunton	3·34	,,	Tipperary, Henry St....	4·71
VI.	Bristol, Ashleydown ...	3·76	,,	Newcastle West	5·32
,,	Wem, Sansaw Hall.....	2·17	,,	Kilrush	3·99
,,	Cheadle, The Heath Ho.	4·09	,,	Corofin	4·09
,,	Bickenhill Vicarage ...	..	XXI.	Kilkenny, Butler House	...
VII.	Melton Mowbray	1·87	,,	Ballymore, Eustace ...	...
,,	Horncastle, Bucknall...	2·79	,,	Kilsallaghan.....	3·74
VIII.	Walton-on-the-Hill....	2·84	,,	Navan, Balrath	2·47
,,	Broughton-in-Furness ..	4·27	,,	Athlone, Twyford	3·17
IX.	Wakefield, Stanley Vic.	2·57	,,	Mullingar, Belvedere...	3·01
,,	Ripon, Mickley	4·29	XXII.	Ballinasloe, Kilconnell.	3·09
X.	Gainford	3·68	,,	Clifden, Kylemore	8·31
,,	Haltwhistle, Unthank..	...	,,	Crossmolina, Enniscoe..	...
,,	Shap, Copy Hill	4·30	,,	Carrick-on-Shannon ...	2·46
XI.	Llanfrechfa Grange	8·85	,,	Dowra	2·82
,,	Llandovery	3·70	XXIII.	Rockcorry.....	1·83
,,	Solva	4·80	,,	Warrenpoint	3·79
,,	Castle Malgwyn	4·56	,,	Newtownards	2·64
,,	Rhayader, Nantgwillt..	7·05	,,	Larne, Carnlough	2·71
,,	Carno, Tybrittle	5·04	,,	Bushmills	1·41
,,	Corwen, Rhug	2·73	,,	Buncrana, Rockfort ...	1·69

FEBRUARY, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	3·77	+ 2·55	·76	10	24	53·8	9	25·2	24	11	18
II.		Maidstone (Hunton Court)	2·97	+ 1·75	·58	10	18	...	...	...	...	...	...
,,		Selborne (The Wakes)	4·71	+ 3·00	·76	8	22	49·5	7,8	19·5	24	15	21
III.		Hitchen	2·65	+ 1·39	·46	10	22	50·0	9	18·0	23	17	...
,,		Banbury	2·89	+ 1·46	·38	8	23	52·8	9	22·0	23	...	17
IV.		Bury St. Edmunds (Culford)	3·23	+ 1·81	·94	10	20	55·0	9	20·0	23	15	21
,,		Norwich (Sprowston)	3·01	...	·64	10	20	...	...	...	...	...	...
V.		Bridport	4·41	+ 2·35	·57	8	22	...	...	...	...	...	...
,,		Barnstaple	6·37	+ 4·29	·85	25	25	56·0	10‖	24·0	25	...	...
,,		Bodmin	6·27	+ 3·48	·69	18§	25	52·0	9	23·0	25	8	13
VI.		Cirencester	5·16	+ 3·55	·66	8	22	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	2·26	+ 2·37	·35	8	17	50·0	9	21·0	20	18	21
,,		Tenbury (Orleton)	3·35	+ 1·78	·45	8	22	54·8	9	15·0	25	15	18
VII.		Leicester (Town Museum)	1·96	...	·30	8	22	54·8	9	23·6	24	10	21
,,		Boston	2·25	+ 1·04	·78	8	12	55·0	9	23·0	24	11	...
,,		Grimsby (Killingholme)	2·91	...	·43	8	23	53·0	9	27·0	22	10	...
,,		Mansfield	3·01	...	·54	13	20	52·1	9	19·0	24	15	16
VIII.		Manchester (Ardwick)	...	...	...	...	...	...	...	...	...	...	...
IX.		York	2·22	+ ·84	·43	15	17	48·0	6	25·0	25	...	...
,,		Skipton (Arncliffe)	3·21	— ·46	·66	5	21	...	...	...	..	...	...
X.		North Shields	3·05	+ 1·52	·41	16	25	45·6	6	24·8	22	14	14
,,		Borrowdale (Seathwaite)	7·93	+ 3·45	1·49	6	18	...	...	...	...	...	...
XI.	WALES.	Cardiff (Crockherbtown)	5·95	...	·86	20	23	53·2	9	24·8	23	11	...
,,		Haverfordwest	6·65	+ 3·79	·91	8	22	52·5	11	23·0	24	10	13
,,		Aberdovey	...	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	3·19	+ 1·84	·78	15	16	50·8	10	28·2	1	6	...
XII.	SCOTLAND.	Cargen	2·99	+ ·40	·72	15	13	49·6	7	23·0	22	15	...
,,		Hawick (Silverbut Hall)	2·19	...	·26	2	21	...	...	..	...	...	...
XIV.		Annanhill	1·52	...	·25	16	17	48·1	8	19·0	20	18	23
XVI.		Kilmory	1·97	...	·35	4	14	...	...	21·0	26	18	...
,,		Mull (Quinish)	2·90	...	·68	7	12	45·0	27	30·0	22	9	..
,,		Loch Leven	4·60	+ 2·30	1·00	17	14	...	...	...	...	...	...
,,		Tyndrum (Ewick)	...	...	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	3·40	+ 1·55	·72	18	15	45·0	7	15·0	20	14	...
,,		Braemar	1·62	— ·36	·38	16	19	46·2	27	4·5	22	11	27
XVIII		Aberdeen	...	...	...	...	...	...	...	...	...	..	...
,,		Portree	2·67	— 7·56	·51	5	16	...	...	...	...	...	...
,,		Inverness (Culloden)	·44	— 1·41	...	...	11	50·9	7	19·0	22	13	28
XIX.		Dunrobin	1·15	— 1·37	·41	16	12	50·2	7	22·0	22	17	...
,,		Sandwick	1·25	— 1·23	·21	16*	21	47·7	27	24·3	19	13	22
XX.	IRELAND.	Cork	3·80	...	1·27	2	19	...	...	...	...	...	...
,,		Caherciveen Darrynane Abbey	6·40	...	·64	8	23	...	...	...	...	...	...
,,		Waterford	5·15	+ 3·12	1·08	1	24	54·0	27	28·0	26	10	...
,,		Killaloe	5·40	+ 2·50	·75	5	22	55·0	13	26·0	21‡	11	...
XXI.		Portarlington	3·12	+ 1·09	·54	8	25	51·0	5	27·5	25	14	..
,,		Monkstown, Dublin	3·17	+ 1·53	·86	1	15	...	...	...	...	...	...
XXII.		Galway	4·05	..	·66	1	21	52·0	13†	27·0	22	11	...
XXIII		Waringstown	1·68	...	·21	8	23	52·0	7	21·0	25	16	22
,,		Edenfel (Omagh)	1·82	...	·28	13	17	49·0	5¶	22·0	25	17	...
,,		Ballyshannon	...	...	...	...	...	...	...	...	...	...	...

* And 26. † And 14. ‡ And 26. § And 10. ‖ And 15. ¶ And 27.
+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON FEBRUARY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

SELBORNE.—The mean atmospheric pressure of the month was lower than I have ever before recorded. Very cloudy; the sun only appeared twice during the whole month, and then very imperfectly. Dense fogs in the early part of the month.

SPROWSTON.—The wettest February known in Norfolk with the exception of February, 1866. A very cold month; more or less frost for the past twelve or thirteen weeks.

BODMIN.—Mean barometric pressure 29·56 in., the lowest recorded for many years; mean temp. 42°·2; H on the 17th, 18th, and 20th.

SHIFNAL.—Another cold winterly month, the sun being scarcely visible throughout. Max. temp. only once reached 50°, and the min. was below 32° on 18 nights. R or S almost daily till 9th, when the ther. rose, accompanied by a great and sudden fall of the bar., which was not followed either by wind or R. Very destructive to vegetation, many tender plants being killed, but Laurestinus was scarcely touched. Snowdrops up on 4th; Catkins out on 12th. A few starlings came back, and one or two throstles appeared; blackbirds have escaped.

LEICESTER.—Seven inches of S on the 23rd.

KILLINGHOLME.—The wettest February for many years. Absence of sunshine remarkable throughout the whole winter. Bees abroad and thrush singing on 8th. L at midnight on 20th. Shade temp. at noon on 22nd, 33° while the sun was shining brightly.

SEATHWAITE.—Severe frost and S during the month.

WALES.

HAVERFORDWEST.—This has been the wettest February (6·65 in.) I have recorded in the last 30 years, slightly exceeding February, 1872 (6·62 in.) S fell heavily on six days, covering the whole country from the 16th to the end. Wind pretty equally divided between W.N.W. and E.S.E., last four days N.E. Three notable depressions of the bar., 10th, 17th (9 a.m. 28·976), and 20th. Floods on 7th and 8th. Violent squalls on 5th. S on 21st 7 to 8 in. deep.

LLANDUDNO.—Notwithstanding about eight very fine days, the month was, as a whole, stormy and inclement, and the mean temp. was more than 4°·5 below the average, although the temp. never fell below 28°·2. Rainfall greatly above the average.

SCOTLAND.

CARGEN.—Easterly winds prevailed during 20 days—a very unusual amount. Mean temp. 36°·1, 3°·8 below the average.

HAWICK.—A most severe winter. Throstles disappeared at the beginning of December, and were not seen again till February 26th. Farm and garden work are far in arrear, and nearly all garden vegetables have been killed by frost. A great winter in the annals of skating and curling.

ARBROATH.—Rainfall 1·53 in. above the average of 37 years.

PORTREE.—A month of severe frost and S showers. Rainfall 7·96 in. below the average of 12 years. A very fine lunar halo on 4th.

DUNROBIN:—Frosty and cold; ground in most places covered with S nearly all the month. Outdoor work very much behind. Stock on sheep farms has suffered greatly in consequence of the protracted S.

SANDWICK.—Very cold, but rainfall only half the average. The ice formed on the Lochs in November remained till February 16th, and new ice was formed on the 18th. Gales of 40 miles an hour on 15th, 16th, and 17th. Large lunar halo on 4th.

IRELAND.

KILLALOE.—Mean temp. 40°·6, being below the average. Sharp frost on several nights. Vegetation very backward.

MONKSTOWN.—The month commenced with heavy S, which, however, soon melted, and was followed by heavy R; then milder weather with a good deal of R at night and fair days. S fell heavily on 19th, but quickly melted, and was succeeded by hard frost. The end of the month was fine and mild, with occasional slight frosts at night. Scarcely any progress in vegetation except crocuses and snowdrops.

WARINGSTOWN.—Cold and damp, but the R, though frequent, fell in small quantities.

EXTRAORDINARY METEOR.

[Occurring at the normal hour of sleep, observations of this splendid meteor are so scarce that we gather all the scraps we can.—ED.]

To the Editor of the Eastern Morning News.

SIR,—As I had the privilege of witnessing the passage of the meteor which was visible here on Monday morning, I beg to supply the following details for the information of your readers:—Standing at my front door at 2.52 a.m. I was startled by the road becoming suddenly illumined. On turning round, I saw a large luminous circular body of primrose-coloured flame at an elevation of about 60 deg. towards east by north. It slowly travelled towards the west, giving me the impression that it followed a course from E. by N. to W. by S. As it approached the horizon it began to lengthen, but never seemed to be more than about four times the length of its diameter, which was somewhat less than that of the full moon, and as it lengthened its hinder portion assumed some of the colours of the rainbow—red and green—but lacking brilliancy. When about 20 degrees from the horizon it suddenly disappeared. After I lost sight of the meteor I supposed all the wonder was at an end, but when rather more than two minutes had elapsed I heard a thud, as of a falling body, and then a reverberating sound. The thud was accompanied by a rattling noise as if the house where being shaken, and the thud seemed at first like the noise which would be made by a child falling on its head on the floor, but it was softened down, and it and the reverberation were evidently mellowed by distance; and I, not venturing at the time to ascribe them to the meteor, likened them to the sound of a somewhat heavy gun fired about twelve miles up the river. It struck me at the time that the prismatic colours exhibited were due to the passage of the meteor behind a veil of snow clouds, gradually becoming denser until at length—near the horizon—they hid the light altogether.

Obediently yours,

S. WALLIKER.

Newington, near Hull, 25th February, 1879.

The following account is given by the Liverpool correspondent of the *Times*:—"About twelve minutes to three o'clock this (Monday) morning an exceptionally brilliant meteor shot across the sky in a south-easterly direction. It did not appear to move with the customary speed, for even in streets whence only a circumscribed view of the heavens is obtainable there was time for the first observers of the meteor to call the attention of others to its passage, though the bright reflection was of itself sufficient to attract the notice of even the least observant."

The *York Herald* of yesterday says that shortly before three a.m. on the 24th, many of the citizens were aroused from their slumbers by hearing what appeared to be a heavy peal of thunder, accompanied by the shaking of windows and, as some supposed, the movement of their beds. From what we have been able to gather from the police and others who were out at the time, the sound was preceded by the appearance of a pear-shaped ball of fire in the northern heavens, which travelled slowly downwards towards the horizon, and emitting scintillations and a light of great brilliancy, almost equal to that of day—so great, indeed, that it is said the smallest print could have been read.

SUGGESTED RAINFALL ZONES.

To the Editor of the Meteorological Magazine.

SIR,—An article appeared in the number of *Nature* of January 30th last, respecting the "Rainfall of the World," and suggesting the probability of the existence of five zones of the prevalence of rainfall. It may be mentioned to your readers that a similar proposition was advanced by myself in treating of "Rainfall at Sea" in a communication to the Meteorological Society of London, on March 20th, 1878. It was then suggested to recognise an *equatorial* belt, north and south *tropical* ones, and north and south *temperate* ones. The spaces of latitudes in the north and south hemispheres would be thus divided into five wet and four dry regions. There were no materials available for the rainfall in the Pacific Ocean, away from the surrounding continents, and therefore the above scheme is not intended to apply to it, but only to the Atlantic, Indian, Chinese, and Australian Seas. Indeed, I learn from naval officers that there is great paucity of rain about the equatorial regions in the Pacific Ocean, so that the existence of a rain belt there is hardly to be conjectured yet, though some such may hold further south.—I remain, your obedient servant,

W. J. BLACK.

Edinburgh, February, 1879.

A METEOROLOGICAL POST CARD.

We reprint in fac-simile one of the neatest summaries we have yet seen. If Mr. Peele had written British Columbia instead of B.C., and had added the latitude (49° 10′ N), longitude (123° 0′ W), and altitude, it is not easy to see how to improve upon it.

Meteorological Observations taken at New Westminster, B. C.

A. PEELE, Observer.

1877.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Synopsis.
Mean Temperature	37.0	42.3	44.9	49.9	54.5	58.4	**63.7**	**63.0**	54.8	49.1	43.4	39.9	50.7 mean.
Maximum	54.0	57.0	57.0	72.0	79.0	77.0	**91.0**	**84.0**	81.5	68.0	55.0	57.0	91.0 highest.
Minimum	20.0	27.0	25.0	31.0	41.0	46.0	48.0	47.0	57.0	30.0	30.5	24.0	20.0 lowest.
Rain Fall	7.35	4.95	7.47	1.55	1.62	2.65	1.03	2.78	6.15	4.65	9.96	5.81	55.97 inches.
Number days Rain	15	13	13	7	12	13	8	8	17	10	24	20	160 in the year.
Greatest days fall	1.15	0.99	1.95	0.73	0.60	0.86	0.38	0.90	1.23	1.95	1.96	1.53	1.96 in 24 hours.
Number days Snow	3	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	4 in the year.
Amount of Snow	8.50	.....	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	9.00 in the year.
Greatest days fall	6.00	.....	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	6.00 in 24 hours.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

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THE WINTER OF 1878-9.

We have been favoured by Mr. F. Slade, C.E., of Barrow, with copies of a very interesting diagram representing the observations made at his station in North Lancashire during last winter, and he has added considerably to its value by the information contained in the following explanatory letter. Mr. Marshall takes up the subject in another form illustrative of the meteorology of the West Riding of Yorkshire; and finally, we add a few data respecting the weather experienced in the North of London during the past winter, and the twenty winters immediately preceding it.

THE WINTER OF 1878 AND 1879.

To the Editor of the Meteorological Magazine.

SIR,—It will be necessary to say a few words in explanation of the weather diagram which accompanies this letter. The arrows on the top point to the direction *from* which the wind blows. The velocity of the wind was registered by a Robinson's Anemometer. The figures underneath represent for the months of November and December, the force in lbs. per superficial foot at 8 a.m. and 5 p.m. The anemometer not being in use for January and February, the Beaufort scale was adopted. The barometer readings are from a Fortin's Standard Barometer, and corrected to 32° Fahr. and sea level. The maximum and minimum self-registering standard thermometers are enclosed in a Stevenson's Screen, four feet above the ground. The dotted blue line represents the minimum temperature registered by a radiation thermometer on the grass. The rain gauge

is 8 inches in diameter, 2 feet above the ground and 60 feet above sea level; and the snow collected in the gauge was melted and registered as rain.

The winter may be said to have commenced on the 11th of November. On that day snow fell from 11.30 a.m. to 4 p.m., leaving a layer on the ground fully 4½ inches in depth; but it was not till the 25th that the severe frost set in which continued, with two intermissions (of the last three days in December, and the 14th and 15th of January), till the 5th of February, or more than ten weeks. Another fall of snow took place from 4 a.m. to 7 a.m. on the 12th December, covering the ground to the depth of 2 inches. This was followed by frequent storms of snow and sleet during the next fortnight. The coldest period was from the 13th to the 17th December; on the latter day the minimum thermometer registered 16° Fahr. During this period we were enveloped in a thick fog, with constant showers of sleet and fine rain, which covered the upper surface of everything exposed to it with rime, and the thin coating of glazed ice on the branches and twigs of the trees and shrubs produced a very rare and beautiful phenomenon. The following week the roads were covered with a sheet of ice, and on Christmas Day a very heavy fall of snow took place, commencing at 8 p.m.; the next morning it lay 6 inches deep on the ground. This apparently cleared the atmosphere. On the 28th a thaw set in, and on the 30th the snow which had lain on the ground since the 12th, had quite disappeared. The frost set in again on New Year's Day. On the afternoon of the 12th of January there was a heavy fall of snow, which turned to rain at 8 p.m. The following day was mild, and a general thaw took place. On the 16th the severe frost returned, and continued to the 5th of February, during which time the roads were covered with snow and ice. We had then a period of warm genial weather. From the 18th to the 26th of the month the nights were frosty and the wind bitterly cold.

The following table gives the temperature for the four months:—

	1878.		1879.		Mean of the four months, Nov. to Feb.
	Nov.	Dec.	Jan.	Feb.	
Mean max.	44°·9	38°·0	36°·4	41°·9	40°·3
Mean min.	34 ·7	28 ·3	28 ·4	33 ·4	31 ·2
do. on grass	31 ·4	25 ·5	25 ·4	31 ·1	28 ·3
Mean temp. of air.....	39 ·8	33 ·2	32 ·4	37 ·6	35 ·8
No. of nights below 32° ...	20	27	29	16	Total... 92

This has been an exceptionally severe winter for Barrow-in-Furness.—Yours truly,

FREDK. SLADE.

Barrow-in-Furness, March 31*st*, 1879.

To the Editor of the Meteorological Magazine.

SIR,—The results of Mr. Stow's thermometrical observations during the past winter, which you published in your magazine for this month, would have been more interesting if similar results for previous winters had been added for comparison. As regards some of the principal items given by him, I have an account for the five previous as well as the last winter here, and I send you with this a copy for use in case you should think it worth notice. Mr. Stow's figures arranged in the same form show a very similar result for the past winter at Aysgarth and here, and are more nearly alike, I think, than could have been expected.

H. C. MARSHALL.

Weetwood Hall, Leeds, March 25th, 1879.

Weetwood Hall, Leeds. 400 *feet above Sea Level.*

	November.					December.					January.					February.					Summary of 4 Months.				
	Extremes.		Mean Daily.			Extremes.		Mean Daily.			Extremes.		Mean Daily.			Extremes.		Mean Daily.			Extremes.		Mean Daily.		
	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1873–74 ...	54	28	46·0	36·7	41·4	54	25	45·3	36·3	40·8	51	29	45·0	34·9	40·0	48	21	42·1	31·4	36·8	54	21	44·6	34·8	39·7
1874–75 ...	56	25	44·6	34·9	39·8	46	13	35·1	26·2	30·6	51	17	44·0	36·0	40·0	50	22	38·6	30·8	34·7	56	13	40·6	31·9	36·3
1875–76 ...	55	29	43·9	35·1	39·5	52	24	41·7	34·6	38·1	52	20	40·5	32·2	36·3	54	25	43·8	33·7	38·7	55	20	42·5	33·9	38·2
1876–77 ...	53	27	44·7	35·6	40·1	52	27	43·5	35·9	39·7	55	27	43·3	33·3	38·3	51	19	45·5	34·9	40·2	55	19	44·2	34·9	39·6
1877–78 ...	55	29	46·9	36·9	41·9	49	23	42·7	34·5	38·6	51	23	41·6	34·0	37·8	56	26	44·6	35·6	40·1	56	23	43·9	35·2	39·6
5 years ...	56	25	45·2	35·8	40·5	54	13	41·6	33·5	37·6	55	17	42·9	34·1	38·5	56	19	42·9	33·3	38·1	56	13	43·2	34·1	38·7
1878–79 ...	46	26	41·4	32·1	36·7	48	9	34·3	25·5	29·9	44	18	33·6	24·8	29·2	49	23	39·2	31·3	35·2	49	9	37·1	28·4	32·7

Aysgarth Vicarage, Bedale. 660 *feet above Sea Level.*

1878–79 ...	47·6	26·0	40·7	32·0	36·1	48·0	7·2	34·7	24·1	29·5	45·0	10·6	33·6	23·9	28·7	47·3	20·0	36·8	29·6	33·2	48·0	7·2	36·4	27·4	31·9

Winter Temperatures observed at Camden Town by G. J. Symons, F.R.S.

Winters.	November.					December.					January.					February.					Summary of 4 Months.				
	Extremes.		Mean Daily.			Extremes.		Mean Daily.			Extremes.		Mean Daily.			Extremes.		Mean Daily.			Extremes.		Mean Daily.		
	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1858–59 ...	56·0	20·1	46·0	33·6	39·8	52·5	24·4	44·5	34·6	39·6	52·6	27·0	44·8	34·2	39·5	57·9	28·7	49·3	35·6	42·5	57·9	20·1	46·1	34·5	40·3
1859–60 ...	59·2	24·3	48·0	36·4	42·2	56·4	14·4	40·8	31·6	36·2	54·8	27·2	44·7	35·0	39·9	52·4	23·2	41·2	30·3	35·7	59·2	14·4	43·7	33·3	38·5
1860–61 ...	53·2	31·2	46·0	36·2	41·1	53·5	6·7	40·5	32·1	36·3	52·4	24·4	38·4	28·9	33·6	54·7	23·2	47·6	36·8	42·2	54·7	6·7	43·1	33·5	38·3
1861–62 ...	57·6	21·8	47·3	34·2	40·7	53·2	21·6	45·7	35·1	40·4	55·3	18·1	43·5	33·7	38·6	56·1	23·2	45·7	36·9	41·3	57·6	18·1	45·5	35·0	40·3
1862–63 ...	56·9	23·7	43·9	34·4	39·2	54·3	30·3	47·0	38·5	42·7	53·7	26·7	46·2	37·6	41·9	53·6	24·5	48·0	36·0	42·0	56·9	23·7	46·3	36·6	41·4
1863–64 ...	59·5	27·3	50·7	40·1	45·4	53·9	26·4	48·7	36·9	42·8	53·8	15·1	41·0	32·5	36·8	54·4	18·9	42·0	31·4	36·2	59·5	15·1	45·6	35·2	40·4
1864–65 ...	54·5	26·2	48·8	35·3	42·1	51·5	17·8	42·3	34·4	38·3	50·8	18·0	40·9	31·5	36·2	52·8	15·4	38·4	32·3	35·4	54·5	15·4	42·6	33·4	38·0
1865–66 ...	57·0	31·2	50·6	40·0	45·3	52·5	30·8	46·5	38·5	42·5	54·2	22·7	47·6	38·3	42·9	55·8	25·2	47·2	36·1	41·6	57·0	22·7	48·0	38·3	43·1
1866–67 ...	62·4	27·4	51·0	38·4	44·7	56·5	27·3	48·1	37·9	43·0	56·0	6·7	39·7	29·3	34·5	56·2	30·0	54·3	40·2	47·3	62·4	6·7	48·3	36·4	42·5
1867–68 ...	62·6	26·4	47·7	35·9	41·8	54·9	22·5	42·3	32·5	37·4	53·0	23·4	41·5	33·0	37·3	62·5	26·6	50·1	38·3	44·2	62·6	22·5	45·4	35·0	40·2
1868–69 ...	59·3	25·4	47·2	36·5	41·9	58·2	31·5	50·7	41·0	45·9	56·3	25·0	46·3	35·9	41·1	60·8	31·3	51·7	40·6	46·1	60·8	25·0	49·0	38·5	43·8
1869–70 ...	58·2	27·6	49·1	37·4	43·3	57·7	20·8	43·3	33·3	38·3	51·7	21·2	43·4	34·4	38·9	54·9	20·1	41·8	32·4	37·1	58·2	20·1	44·4	34·4	39·4
1870–71 ...	56·4	27·3	48·0	36·2	42·1	57·2	14·0	38·3	29·9	34·1	45·2	19·7	37·4	29·5	33·4	56·2	25·8	48·1	37·5	42·8	57·2	14·0	42·9	33·3	38·1
1871–72 ...	52·5	21·0	43·6	32·8	38·2	49·0	20·1	42·7	34·2	38·5	52·8	27·4	46·1	36·3	41·2	57·0	31·4	51·1	39·3	45·2	57·0	20·1	45·9	35·6	40·8
1872–73 ...	61·2	31·7	50·9	40·2	45·5	54·6	26·6	47·0	38·2	42·6	53·9	28·4	46·7	38·3	42·5	50·1	25·8	39·5	31·3	35·4	61·2	25·8	46·0	37·0	41·5
1873–74 ...	58·1	27·7	50·1	38·8	44·5	56·7	22·9	45·8	35·8	40·8	55·4	28·0	47·4	35·9	41·6	54·5	22·4	44·8	33·3	39·1	58·1	22·4	47·0	36·0	41·5
1874–75 ...	60·0	25·6	47·4	36·9	42·2	53·8	18·4	38·1	28·7	33·4	53·8	20·7	48·2	39·2	43·7	51·2	25·1	40·8	31·0	35·9	60·0	18·4	43·6	33·9	38·8
1875–76 ...	58·8	29·0	48·1	37·2	42·7	54·8	23·2	42·9	34·8	38·8	54·8	18·9	42·5	31·5	37·0	58·6	23·0	46·7	36·6	41·6	58·8	18·9	45·0	35·0	40·0
1876–77 ...	61·4	27·6	49·7	38·8	44·2	56·6	28·0	47·8	40·4	44·1	56·4	28·5	48·5	37·4	43·0	58·5	25·3	49·4	38·6	44·0	61·4	25·3	48·9	38·8	43·8
1877–78 ...	59·1	31·2	52·3	39·6	45·9	54·2	28·3	45·6	35·5	40·5	55·6	26·9	45·2	35·5	40·4	59·7	25·7	47·7	37·7	42·7	59·7	25·7	47·7	37·1	42·4
20 Yrs. Max...	62·6	31·7	52·3	40·2	45·9	58·2	31·5	50·7	41·0	45·9	56·4	28·5	48·5	39·2	43·7	62·5	31·4	54·3	40·6	47·3	62·6	25·8	49·0	38·8	43·8
20 Yrs. Min....	52·5	20·1	43·6	32·8	38·2	49·0	6·7	38·1	28·7	33·4	45·2	6·7	37·4	28·9	33·4	50·1	15·4	38·4	30·3	35·4	54·5	6·7	42·6	33·3	38·0
20 Yrs. Mean..	58·2	26·7	48·3	36·9	42·6	54·6	22·8	44·4	35·2	39·8	53·6	22·7	44·0	34·4	39·2	55·9	24·7	46·3	35·6	40·9	58·7	19·1	45·8	35·5	40·7
1878–79 ...	53·5	29·4	44·9	34·8	39·9	55·2	18·7	38·2	29·5	33 9	51·0	19·2	35·8	28·7	32·2	53·8	25·2	43·0	34·0	38·5	55·2	18·7	40·5	31·7	36·1
Diff. from Mean ...	−4·7	+2·7	−3·4	−2·1	−2·7	+·6	−4·1	−6·2	−5·7	−5·9	−2·6	−3·5	−8·2	−5·7	−7·0	−2·1	+·5	−3·3	−1·6	−2·4	−3·5	−·4	−5·3	−3·8	−4·6

The value of the preceding summary of the temperature of twenty-one consecutive winters will be increased by the addition of a few facts respecting the instruments and their position, and also by a few remarks upon the leading peculiarities revealed by the table.

First as to the instruments. None but verified ones have been used, and the same minimum thermometer has been used throughout the whole period. One maximum thermometer was broken, but both it and its successor were absolutely without error. All the observations have been made with the thermometers upon a Glaisher's stand, or more strictly on Glaisher's stands, for the wood of the first perished and a new one identical in dimensions was substituted. The position of the stand has been changed twice, but all three stations are within a circle a quarter of a mile in diameter, and the ground is at the same altitude within 10 feet.

The remarkable feature of the winter of 1878-79 was its persistent low temperature. We have had colder Novembers, colder Decembers, and colder Februarys, but take the three consecutive months November to January, and there is no equal during the twenty years. The mean for those three months during the twenty years is 40°·5, the mean during 1878-79 was only 35°·3, or 5°·2 less than the average, and 1°·2 less than in 1870-71, the coldest winter of the twenty.

But the continuance of the cold through February adds to the exceptional features of the season. The mean temperature of February is 40°·9, but in 1879 it was 2°·4 lower, and although there have been, as already mentioned, colder Februarys, *e.g.* 1873, when the mean was only 35°·4, yet there have only been six colder ones during twenty years.

Lastly, if we take the long period of four months, November to February, both inclusive, we find that there is no winter of which the mean temperature has been so cold by nearly two degrees as in the one which we have just passed through.

As the long continuance of the cold is such as rarely to have been equalled, we think that it would be useful if one general table were compiled from all the British stations using verified instruments placed in Stevenson's screens, the table to contain precisely the data selected by Mr. Marshall. There would be no harm in giving a second table compiled from observations made with instruments presumed to be correct, but not actually verified, and also with others verified, but not in Stevenson's screens. Those who may be willing to supply data for such a table are requested to give full particulars both as to the instruments and their position, and to send them before May 1st.

COWL AND ANEMOMETER TESTING AT KEW OBSERVATORY.

WE mentioned last year that a series of comparisons was being made in the experimental house at Kew upon the merits of certain so-called suction cowls, intended to draw air up tubes on the top of which they were placed.

The experimental house is a barn-shaped structure of wood. Several tubes were taken through the ridge, and down to 3 ft. or 4ft. above the ground. A cup anemometer was placed at one end of the building arranged to read inside. The various cowls were placed on the top of the pipes, and, the only supply of air being from one open plank the whole length of the building, it was considered that the pipes had equal advantages; as, however, the draught up the tubes varied with the direction of the wind, care was taken that the pipe bearing each cowl when it was being specially tested should have an open one on each side of it, and we believe also that comparisons during which the direction changed were rejected. The velocity of the current up each air pipe was measured by the usual small air meter. Finally the following report was issued:—

"The Sub-Committee appointed at Leamington to test the ventilating Exhaust Cowls beg to report that they have given the matter their most careful attention, and carried out at the Royal Observatory, Kew, an elaborate series of about 100 experiments, on seven different days, at different times of the day, and under different conditions of wind and temperature. After comparing the Cowls very carefully with each other, and all of them with a plain open pipe as the simplest and in fact only available standard, the Sub-Committee find that none of the Exhaust Cowls cause a more rapid current of air than prevails in an open pipe under similar conditions but without any cowl fitted on it. The only use of the Cowls, therefore, appears to be to exclude rain from the ventilating pipes, and as this can be done equally if not more efficiently in other and simpler ways, without diminishing the rapidity of the current in the open pipe, the Sub-Committee are unable to recommend the grant of the medal of the Sanitary Institute of Great Britain to any of the Exhaust Cowls submitted to them for trial.

W. EASSIE.
ROGERS FIELD.
May 30th, 1878. DOUGLAS GALTON."

In our previous notice we expressed the belief that the experiments would throw some light upon the influence of the shape and aspect of buildings, upon the indications of anemometers placed upon them, and we believe that that was the case, although the above report gives no information. Moreover, we believe that the experiments have already led to some important modifications respecting air meters, and to the investigation of some points in the construction of anemometers. We understand that the Council of the Sanitary Institute

have passed a resolution re-appointing Captain Douglas Galton, C.B., F.R.S., Rogers Field, B.A., M. Inst. C.E., and W. Eassie, C.E., as a Committee to further investigate the whole subject of ventilation by automatic means, and to extend the enquiry to other appliances for ventilation besides those already submitted to trial, with a view to the publication of the detailed results. By permission of the Kew Committee of the Royal Society the experiments will be carried out at Kew Observatory.

The expense of the contemplated inquiry will be considerable, and the Sanitary Institute have not at the present time funds available for this purpose. It is therefore proposed to raise the requisite fund by special subscription among those interested in the thorough investigation of the subject.

Subscribers of a guinea and upwards will be entitled to receive a copy of the detailed results of the experiments when published.

Subscriptions to be forwarded to Rogers Field, Hon. Treasurer, 5, Cannon Row, Westminster, and cheques crossed London and Westminster Bank. About £160 has already been subscribed in sums ranging from £100 to £1 1s. 0d.

There can be no doubt as to the importance of the subject; the committee is a small one and calculated to ensure confidence; the report will be pretty certain to contain details of value; and, therefore, we think that few will find the investment of a guinea (or more) a bad speculation.

THE PREVALENCE OF FOGS.

To the Editor of the Meteorological Magazine.

SIR,—In your notice of "The Fenland, Past and Present," vol. xiii. p. 135, you expressed some astonishment at the figures given in a table, on the *prevalence of fogs* in the Fens, and said "We do not remember ever seeing a table of prevalence of fogs." Some little discussion followed that review, in which it was stated that a record of fogs was being continued in the district.

I do not write to re-open that discussion, but to state what has been observed, and with a view to induce your numerous correspondents, and meteorologists generally, to give publicity to their records on this subject; for it has occurred to me that fogs and the various phenomena attending them are not sufficiently discussed. Great disasters both by land and sea occur when we are enveloped by them, and it might be as important often to give warnings of the approach of fogs as of gales, and if they are found in certain localities to accompany anticyclones, or any determined atmospheric condition, we should be warned of their approach as we are now of that of a cyclone.

But I must now confine my remarks to records of fogs made for me by Mr. James Long, of Wisbech, and to those made at my station

at Lowestoft, and simply to the dates of their occurrence. I trust others will give records for comparison, so that a more general discussion of them and their attendant phenomena may result in the future.

Fogs at Wisbech, Nov. and Dec., 1878.

Nov. 19.	Thick, all day.	Dec. 13.	Very dense fog all day, objects invisible at 45 yards.
,, 20.	Do. do.	,, 16.	Very foggy all day.
,, 24.	Do. do.	,, 20.	Fog and frost.
,, 27.	Do. do.	,, 25.	Fog all day.
Dec. 1.	Thick, p.m.		
,, 7.	Do. do.		
,, 10.	Rather foggy, snow.		

1879.—Jan. 1st to March 31st. No fog.

Fogs at Lowestoft, Nov. and Dec., 1878.

Nov.	None.	Dec. 16.	Slight, all day.
Dec. 7.	Slight, a.m.	,, 26.	Do. do.
Dec. 12.	Slight, all day.	,, 27.	Thick, all day.

1879.—Jan 12–13. Slight.
Feb. 2. Thick, 7 p.m., for 15 hours.
March 31. Slight, a.m.

Yours faithfully, S. H. MILLER.

Belle Vue Park, Lowestoft, 4th April, 1879.

THE EXTRAORDINARY METEOR OF MARCH 24TH.

To the Editor of the Meteorological Magazine.

SIR,—The meteor described in your last number was observed also at March. A brilliant flash of light was seen, and after a short time it was followed by a noise like an explosion. A policeman on duty in the High Street was greatly alarmed by the light, and described the noise as a low rumbling sound like distant thunder, which made the ground tremble and shook several windows; while the light lasted, which was only for a few seconds, everything was illuminated. Superintendent Burrows saw a most brilliant light, which appeared to him to burst in the air, followed by the rumbling sound.—Yours truly,

JAMES GREEN.

The Cross, March.

FROST PHENOMENA.

To the Editor of the Meteorological Magazine.

DEAR SIR,—Doctors differ. I have been a cultivator of the soil for close on half a century, and I must say I agree with Mr. Bicknell and not with Mr. Mathison. I have never been so free from slugs as this year, and I usually suffer severely from them. Even the Scilla Siberica, which has usually been cut off almost before it came through the ground, is untouched, though nothing has been done to

protect it, and all the larkspur family, which I have usually to take means to preserve, are being let alone. The slugs are of course not extinct, but they have manifestly been severely thinned.

Yours truly,

THOS. WARING.

Waringstown, Co. Down, April 4th, 1879.

REVIEWS.

Instructions to Observers connected with the Meteorological Service of the Dominion of Canada. By G. T. KINGSTON, M.A., Superintendent. Toronto: Copp, Clark & Co. xviii., 190 pages, 8vo.

ALTHOUGH we are becoming more and more convinced that disproportionate attention is at present bestowed upon the making of meteorological observations, we regard with great satisfaction the rapid succession of volumes instructing observers how to observe and record accurately.

"In Part I. are given the meaning of terms in frequent use, and simple statements of sundry physical facts to which reference is made in subsequent parts of the volume, or of which a knowledge would be useful in reading works on Meteorology." This part is, in fact, a sort of small treatise on Physics, for we have definitions, specific gravity, laws of fluids, heat, principle and construction of thermometers, expansion, specific heat, &c.

The second part treats of the construction and use of Meteorological Instruments, with brief descriptions of certain phenomena. We quote the first section as a specimen of the author's style :—

Measurement of Atmospheric Pressure.—The pressure of the atmosphere at any time and place may be measured by the number of units of pressure exerted by the atmosphere on a unit of surface; for example, by the number of pounds on the square inch. It is customary, however, to measure the atmospheric pressure by the *depth* in inches of mercury in a vessel at the base of which the pressure referred to a unit of surface is the same as the pressure of the air, where the pressure on the upper surface of the mercury is supposed to be nothing, the density of the mercury, that proper to pure mercury at temperature 32°, namely, 13·598, and the force of gravity that which exists at the mean level of the sea in latitude 45°.

This paragraph sufficiently indicates how careful has been the writing of this book, and how careful must be the reading of it. The book is pre-eminently solid and thorough, and although we fear that few observers would thoroughly master it without a headache or two, there is not a shadow of doubt that they would be extremely well instructed.

The observers are (most properly) directed to write all figures, letters and words in a plain, distinct manner, *without flourishes;* never to use vulgar fractions (*i.e.*, never to put $10\frac{1}{2}$, but always 10·5); and, further, that—

Returns of every kind should be carefully compared with the originals by *two persons*, one of whom should read aloud while the other corrects; the

latter of the two operations being done by the more experienced person of the two. The practice enjoined in this article is very important, and one to which, it is feared, sufficient attention has not be given by some correspondents.*

The most serious omission which we notice is that of any remarks upon care in the arithmetical operation of adding and meaning the columns, inaccuracy in which is very prevalent and involves one of two evils—either *delay* pending correspondence with the observer, or *guessing* at the chief office, for it is never possible to determine by inspection whether the error arises from a wrong entry or wrong addition.

In one respect we cannot agree with Prof. Kingston. His staff of observers seem to have a very miscellaneous collection of rain gauges, and this has apparently induced Prof. Kingston to abandon as undesirable the usual course, of supplying measuring jars adapted to the gauges, and instead of so doing, to issue jars divided in cubic inches, leaving to each observer to determine the area of the funnel which he uses, and then to compute the rainfall represented by each tenth of a cubic inch of water collected. As no reference is made to the observers being provided with standard measures of length, and the accurate measurement of the diameter of a rain gauge without a proper tool is not easy, we doubt if the observers determine the area correctly; moreover, no examination of the accuracy of their calculations seems to be made. If so, surely these two sources of error are more dangerous than the risk of sending a 5-inch jar to a station provided with an 8-inch gauge, for the former is an error easily overlooked, the latter so gross that it could hardly escape detection.

We are glad to conclude by calling attention to one feature in this book, which is as good as it is original, viz., a series of photographs of the instruments in position. In a country where the funds are insufficient for frequent inspection, and where the distances between the stations are often very great, it is especially necessary to render the observers as independent of oral instruction as is possible. These photographs must be quite a boon to many of the observers, and all will thank Prof. Kingston for them. The thermometer stand also appears to us very admirable, but we dare not raise that subject in these pages.

Negretti and Zambra's Encyclopœdic Catalogue. London: Negretti and Zambra. viii.–564 pages.

FOR some reason which it is beyond our power even to guess, this volume does not state upon its title page that it is a second edition. There is, however, no doubt about the fact, nor is there any doubt that it is improved and enlarged. Indeed, as to size, binding, and some other points, it seems to be intended to compete with that literary Leviathan, the Post Office London Directory.

* Although the greater part of the volume is extremely free from misprints, there is evidence on page 131 that the above rule was either neglected wholly or in part, even in reading the proofs of these instructions, for there are three wrong values under 29·2, and there is one under 29·3.

Of course, out of so large a volume we could, if it were worth while, collect a grand series of errors; in such a work it is not possible to avoid them, but except quite trivial ones, we have seen few. There is, however, a muddle on pages 205, 6, 7, 9, and 210, where the reference numbers (674 to 693) are used twice over. On page 518 there is a wonderfully droll statement—viz., that a cubic foot of snow weighs 63 lbs. 14 oz. As this is rather more than it would weigh if it were the most dense ice, its inaccuracy is obvious. As Messrs. Negretti give the authority, we must not blame them for the blunder, which occurs originally in the *Instructions* published by Col. Sir H. James—appendix, page 30—where one foot should be ten feet!

The great merit of this catalogue is, that it combines two advantages. As a catalogue it is as nearly perfect as one can expect any catalogue to be, in days when new inventions are more plentiful than gooseberries; and in illustration of, and supplementary to, the descriptions of the instruments, it is becoming quite a mine of short notices, many of which are extremely good. We may quote as illustrating and justifying this statement, the article on Aneroids (pp. 14–17) and the remarks (p. 158) upon the saltness of sea water.

FRENCH HYDRAULICS.

In the spring of 1878 an important commission was appointed by the French Government, to collect and concentrate all available data respecting the régime of the rivers of France, with especial reference to the prevention of floods. We are glad to see the following note in the *Times* of April 8th, and hope before long to receive the report, and lay an abstract of it before our readers.

"The Water Commission is about to consider the means of preventing floods, and an able report has been presented to it by M. Faré, ex-Director-General of Forests, on the temporary absorption of rain by vegetation. He states that deciduous trees intercept 37 per cent. of the rainfall, and firs 55 per cent. A square metre of grass 8 inches thick will absorb 50 kilogrammes (110 lbs., or 2 inches deep) of water, or a volume one-fourth its size. He dwells also on the absorbing powers of the soil and roots of forests."

THE WEATHER IN MARCH.

During the whole of the first week of the month pressure was highest over the southern part of Western Europe, and depressions passed from S.W. to N.E., and from W. to E. over, or near to, our northern and western coasts. At first these disturbances were important, and from the 2nd to the 5th S.W. to W. winds, strong to a gale in force, prevailed over the western and northern parts of this Island, with cloudy or dull weather. During the 6th and the succeeding night, however, the barometer rose decidedly, and from that day till the close of the week high and uniform pressures lay over England, Ireland and France, while in Scotland the gradients for westerly winds were slight. On the 8th pressure was giving way everywhere, and in the N. conditions were again becoming unsettled.

Considerable changes in the weather took place during the second week. On the 9th, though the mercury fell everywhere, a large anticyclone lay over the S. of the British Islands and neighbouring countries, and light to fresh W. breezes

prevailed, with exceedingly fine and warm weather. On the following day the area of uniformly high pressures was more to the southward of us, and the sky became cloudy generally with rain and snow in the west and north. In the S.E., however, the weather was still warm and fair. On the 11th, though the barometer was rising and the weather was fine, the isobars had taken a direction from N.W. to S.E., so that N. breezes had set in and temperature fallen. In the evening of that day the mercury was falling in the N., and by the next morning a complicated depression had advanced over Scotland, giving us strong W. winds in the S., and gales from the E., and snow in the N. This depression passed rapidly to the south-eastward, the wind veered to N., blowing very strong in the north-east and east; as it did so temperature fell rapidly, sharp frost being experienced in the N.

On the 13th an anticyclone lay over these Islands, but in the evening of the same day a small depression appeared on its north-western side, and gradually infringing on it, caused very cold wet snowy weather to prevail generally on the 14th. On the 15th, a band of low pressure lay across Scotland, giving us W. winds in the south, and E. winds in the north, with cloudy unsettled weather.

The distribution of pressure at the beginning of the latter half of March was rather complex, areas of high readings are shewn, one over the South of Scandinavia, stretching westward to the north of Scotland, and a second over the north of Italy, the south of France, and north of Spain, while a band of low pressure lay across England, Ireland, and the North Sea. Strong E. breezes prevailed in the north, and W. ones in the southern portion of Western Europe, the weather being unsettled and mostly cloudy.

During the night of the 16th, the bar. rose briskly over these Islands; and on the day following, an area of high pressure lay over the North Sea, with a small disturbance on our south-west coast, so that S. to S.E. breezes prevailed over the United Kingdom generally. By the 18th the anticyclone had moved south-eastward to North Germany, and readings were lowest to the westward of Ireland. On the 19th, however, pressure had become highest over Scandinavia, and lowest over the Peninsula, so that the wind backed to S.E. to E. generally. During the remainder of the third week of the month pressure continued highest in the north, and lowest in the south, and the prevailing current was E. to N.E. on nearly all coasts.

The weather, after being steadily cold and inclement during the greater part of the last week, became suddenly mild and warm at its close. On the 23rd, 24th and 25th, the highest pressures lay over the south of Scandinavia, and the lowest over the south-east of France; and strong E. breezes, drawing into S.E. in Scotland, and into N.E. over the Bay of Biscay, prevailed, uninterruptedly, with very low temperature for time of year; and on the 24th and 25th much snow and sleet. On the 26th a rather deep depression appeared off our south-western coasts, but the bar. still rose over the Gulf of Bothnia, so that gradients for S.E. winds increased, and the wind which had veered south-eastward generally rose to a fresh to hard gale in many places. This depression moved south-eastward, the wind consequently backed to E. and N.E. again, and temperature which had risen somewhat on the 26th and 27th fell again on the morning of the 28th. During the night of the 27th a very decided rise of the mercury occurred over the Bay of Biscay, and a large depression, which appeared on our south-western coasts during the 28th, moving slowly northward, caused S. gales in the west, with a quick rise of temperature. On the 29th the centre of the depression had reached the Hebrides, where the bar. had fallen 0·6 in.; while over France the mercury rose quickly. In consequence, gradients for W. to. S.W. winds appeared generally, and the weather became much milder.

Temperature was very changeable throughout the month. During the first week, when the wind blew from S.W. to S.E. generally, temperature was high, and the weather altogether very fine and dry. Considerable range was shewn during the second week, the maxima at the beginning being exceptionally high, and the minima at the end unusually low. The third week

was marked by considerable oscillations. It was highest on the 19th, when the ther. reached 64° in London and 68° at Cambridge, but after that date it fell steadily, and at the close of the week the weather had resumed its winterly character. Fogs were prevalent in the former part of the week. The temperature remained low till the 28th, when the wind changing to the south-westward, a good rise of temperature took place. No considerable fall of rain was reported on any day throughout the month. H.E.M.

SUPPLEMENTARY TABLE OF RAINFALL IN MARCH, 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	·98	XI.	Port Madoc	2·50
,,	Littlehampton	·70	,,	Douglas.....	2·45
,,	Horsham, Swallowfield.	...	XII.	Carsphairn	5·14
,,	Hastings, Manor House	·90	,,	Melrose, Abbey Gate...	2·40
,,	Hailsham	·74	XIV.	Lanark, Baronald	...
,,	I. of W., St. Lawrence.	·80	XV.	Islay, Gruinart School..	...
,,	Strathfield Turgiss	·42	XVI.	St. Andrew's, Cambo...	...
III.	Great Missenden.....	·93	,,	Aberfeldy H.R.S.	3·51
,,	Winslow, Addington ...	1·19	XVII.	Tomintoul.....	...
,,	Oxford, Magdalen Col...	·98	,,	Keith H.R.S.	2·68
,,	Northampton	·83	,,	Forres H.R.S.	1·68
,,	Cambridge, Merton Vil.	·85	XVIII.	Strome Ferry H.R.S....	4·74
IV.	Harlow, Sheering	1·19	,,	Lochbroom	3·97
,,	Diss	·99	,,	Auchnasheen H.R.S.	1·94
,,	Swaffham	1·05	,,	Tain, Springfield.....	2·94
,,	Hindringham	·75	,,	Looh Shiel, Glenfinnan.	8·47
V.	Salisbury, Alderbury...	·40	,,	Dalwhinnie H.R.S.....	3·53
,,	Calne, Compton Bassett	·85	XIX.	Lairg H.R.S.	...
,,	Beaminster Vicarage ...	·65	,,	Altnabreac H.R.S.	...
,,	Dartmoor Prison.....	3·28	,,	Watten H.R.S.	1·66
,,	Langtree Wick	1·05	XX.	Fermoy, Glenville	1·96
,,	Lynmouth, Glenthorne.	1·27	,,	Tralee, Godfrey Place...	...
,,	St. Austell, Cosgarne...	1·43	,,	Cahir, Tubrid	1·30
,,	Taunton	·76	,,	Tipperary, Henry St....	1·86
VI.	Bristol, Ashleydown ...	1·02	,,	Newcastle West	1·47
,,	Wem, Sansaw Hall.....	1·62	,,	Kilrush	1·69
,,	Cheadle, The Heath Ho.	1·10	,,	Corofin	2·60
,,	Bickenhill Vicarage ...	...	XXI.	Kilkenny, Butler House	1·67
VII.	Melton Mowbray	·68	,,	Ballymore, Eustace ...	...
,,	Horncastle, Bucknall...	·53	,,	Kilsallaghan.....	2·45
VIII.	Walton-on-the-Hill.....	1·20	,,	Navan, Balrath	1·92
,,	Broughton-in-Furness..	3·15	,,	Athlone, Twyford	1·97
IX.	Wakefield, Stanley Vic.	1·04	,,	Mullingar, Belvedere...	...
,,	Ripon, Mickley	1·69	XXII.	Ballinasloe	2·63
X.	Gainford	1·19	,,	Clifden, Kylemore	5·37
,,	Haltwhistle, Unthank..	2·55	,,	Crossmolina, Enniscoe..	...
,,	Shap, Copy Hill	5·36	,,	Carrick-on-Shannon ...	2·89
XI.	Llanfrechfa Grange	1·76	,,	Dowra	2·47
,,	Llandovery	3·13	XXIII.	Rockcorry.....	2·27
,,	Solva	·80	,,	Warrenpoint	1·96
,,	Castle Malgwyn	...	,,	Newtownards	2·25
,,	Rhayader, Nantgwillt..	4·00	,,	Larne, Carnlough	3·47
,,	Carno, Tybrittle	3·06	,,	Bushmills	1·72
,,	Corwen, Rhug	...	,,	Buncrana, Rockfort ...	2·18

MARCH, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	·91	— 1·17	·14	18	14	63·1	19	29·2	2	11	15
II.		Maidstone (Hunton Court)	·57	— 1·59	·12	30	9	...	...	...	...	...	...
,,		Selborne (The Wakes)	·73	— 1·87	·27	30	7	60·0	19	23·0	8	11	20
III.		Hitchen	·62	— 1·55	·15	30	13	57·0	19	26·0	12	16	...
,,		Banbury	1·02	— 1·18	·19	28	18	59·0	19	25·0	2	18	...
IV.		Bury St. Edmunds (Culford)	·84	— 1·36	·18	10	11	60·0	19†	25·0	1	17	24
,,		Norwich (Sprowston)	...	...	...	...	...	...	...	...	...	...	...
V.		Bridport	·45	— 2·42	·13	29	8	...	...	...	...	...	...
,,		Barnstaple	·78	— 2·37	·23	16	12	62·0	20	28·0	14	...	...
,,		Bodmin	1·28	— 2·47	·32	28	20	60·0	19	28·0	2	9	18
VI.		Cirencester	1·24	— 1·36	·24	28	15	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	·89	— 1·05	·17	16	15	54·0	5‡	23·0	2	15	21
,,		Tenbury (Orleton)	·81	— 1·61	·10	28	15	60·2	9	22·3	2	14	19
VII.		Leicester (Town Museum)	·68	...	·12	28	14	61·0	19	26·6	8	9	22
,,		Boston	·54	— 1·25	·12	26	10	65·0	19	27·0	13	11	...
,,		Grimsby (Killingholme)	·99	...	·14	28	15	55·0	9, 12	25·0	14	5	...
,,		Mansfield	·97	...	·27	26	15	57·5	9	26·8	13	12	15
VIII.		Manchester (Ardwick)	1·89	— ·55	·40	16	16	55·0	8¶	28·0	2	11	...
IX.		York	·80	— 1·19	·13	13	13	57·5	19	25·0	14	9	15
,,		Skipton (Arncliffe)	4·02	— ·79	·77	15	24	...	...	...	...	...	...
X.		North Shields	·80	— 1·55	·26	15	15	55·0	5	20·0	14	10	10
,,		Borrowdale (Seathwaite)	12·14	— 1·26	1·93	2	17	...	...	...	...	...	...
XI.	WALES.	Cardiff (Crockherbtown)	1·14	...	·32	28	14	60·0	19	28·4	2	6	...
,,		Haverfordwest	1·72	— 1·73	·49	16	7	60·0	19	22·5	2	14	19
,,		Aberdovey	...	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	1·46	— ·80	·32	16	12	54·8	8	28·0	26	5	...
XII.	SCOTLAND.	Cargen	2·84	— ·26	·42	18	16	55·0	7	21·0	14	8	...
,,		Hawick (Silverbut Hall)	2·65	...	·47	15	18	...	...	...	...	...	...
XIV.		Annanhill	2·86	...	·66	4	16	53·0	9	23·0	14	14	18
XVI.		Kilmory	5·73	...	1·55	14	20	...	...	22·0	13	21	...
,,		Mull (Quinish)	3·15	...	·54	4	17	...	...	...	...	...	..
,,		Loch Leven	...	...	...	...	...	...	...	...	...	...	...
,,		Tyndrum (Ewick)	...	...	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	2·62	+ ·58	·70	14	14	53·0	5, 9	25·0	14	9	...
,,		Braemar	3·51	+ 1·30	·75	14	19	48·2	19	21·0	14	19	25
XVIII		Aberdeen	...	...	...	...	...	...	...	...	...	...	...
,,		Portree	6·11	— 2·93	·97	3	19	...	...	...	...	...	...
,,		Inverness (Culloden)	2·57	+ ·61	...	...	...	52·3	4	16·2	16	...	...
XIX.		Dunrobin	2·22	— ·40	·50	4	15	56·0	7	21·0	17	11	...
,,		Sandwick	3·23	— ·10	·40	3	18	50·0	8	21·6	15	11	17
XX.	IRELAND.	Cork	1·47	...	·47	29	7	...	...	...	...	...	...
,,		Caherciveen Darrynane Abbey	1·56	...	·33	28	14	...	...	...	...	...	...
,,		Waterford	2·38	— ·51	·64	16	16	57·0	9	29·5	13	7	...
,,		Killaloe	2·28	— 2·04	·31	10*	14	62·0	19	23·0	28	15	...
XXI.		Portarlington	1·81	— 1·50	·38	16	24	54·0	8	27·5	25	12	..
,,		Monkstown, Dublin	1·58	— 1·00	·54	17	12	...	...	...	...	...	...
XXII.		Galway	2·16	...	·53	29	15	55·0	8§	28·0	24‖	9	...
XXIII		Waringstown	2·15	...	·31	17	24	57·0	7, 8	23·0	12	15	20
,,		Edenfel (Omagh)	2·05	...	·34	5	19	56·0	23	23·0	12	16	...
,,		Ballyshannon	...	...	...	...	...	...	..	...	...	...	...

* And 29. † And 29. ‡ And 12, 18, 19. § And 12, 20. ‖ And 26. ¶ 29, 31.

\+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON MARCH.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

SELBORNE.—A remarkably dry month; the wind very variable.

BANBURY.—High wind on five days, S on seven days, H on 30th. Violets in bloom on 28th.

CULFORD.—The month was generally cold and sunless, and vegetation is backward. Very little high wind; 23rd, 24th and 25th very cold, with E. and N.E. winds. Mean temp. 40°·7; polar winds prevailed on 14 days.

BODMIN.—T and L at 5 a.m. on 30th.

SHIFNAL.—March this year both came in and went out like a lamb, but bitter cold intervened, especially from the 22nd to the 29th, when the equinoctial gales coming from the E., with attempts to snow, were deadly cold. Snowdrops full out on 4th; rooks began to build on 6th; ringdove first heard on 17th; apricot in blossom on 29th; celandine flowers and hawthorn buds on 31st.

ORLETON.—Temperature variable, but generally low, with frequent strong drying winds, which were favourable for agricultural work on clay lands. Several bright days with severe frost at night in early part of month; L on the night of the 18th, when there was a TS at Ludlow, 14 miles distant. Lunar halos on 5th and 30th.

BOSTON.—Weather during part of the month intensely cold, with N.E. winds and S. Mean temp. about 1° above the average. The winter frosts and the drying winds got the land in very good order, and the spring seed has been well got in. The young wheat looks strong and healthy, much better than was anticipated.

GRIMSBY.—Very cold month; young lambs suffered from the cold and S, but the precipitation not being great, farm work made good progress. Two inches of S on the ground on 14th; high wind from 22nd to 26th; T and L on 30th; T and H on 31st. Lunar Halo on 30th.

MANCHESTER.—The month opened rather mild, but about the 20th the wind veered to E. and N.E., and the weather became cold. Slight falls of snow on 25th and 26th. T and L in afternoon of 25th.

YORK.—A good month for field and garden work, but vegetation very backward. TS on 30th.

WALES.

HAVERFORDWEST.—A bleak cold month. Rainfall only half the average. First and last weeks very severe, with easterly gales and S. Remarkably fine and warm on 18th and 19th.

SCOTLAND.

HAWICK.—March came in like a lion, and had very few lamb-like days. Hurricanes on 5th and 22nd. S fell to the depth of 7 in. on the 13th. Such a severe March has not been known for many years. Laurel bays have suffered severely, and celery, turnips, and all the brassica tribe, have been reduced to pulp.

PORTREE.—More frost in this month than has ever been known before. Gales on the 4th, 12th, and 30th. Lambs suffering greatly from the cold.

CULLODEN.—Vegetation very backward. Snowdrops, Crocuses, Christmas Roses, Aconitums, and Hepaticas, all late in flowering.

DUNROBIN.—The ground was hardly clear of S when on the 12th 9 in. fell, and 3 in. more on the 15th, putting a stop to most out-door work for the greater part of the month. The snowfall was succeeded by severe frost, which prevailed until the 18th, when thaw and cold E. winds set in.

SANDWICK.—During March there was generally a continuance of cold wintry weather, with S over the plains on nine days, and drift on two of them. There

were gales of 50 miles an hour on the 4th, 9th, and 29th; Auroræ on the 15th and 29th.

IRELAND.

DARRYNANE.—A very dry month, and mild, except from 23rd to 29th, which week was bitterly cold.

KILLALOE.—A good seasonable month, and generally favourable for agriculturists. Frosts rather frequent, and some S from 25th to 28th. Vegetation backward, and all flowering plants much later than usual.

MONKSTOWN.—A dry seasonable month with a good deal of slight frost. On the 22nd the wind shifted to N. and N.E., and continued from that quarter for about a week, with bitterly cold weather and showers of S and H; the last two or three days were fine and mild. Vegetation still very backward.

EDENFEL.—The month was extremely raw, harsh and ungenial. The easterly winds, which prevailed, instead of drying the ground and preparing it for seed, were almost always accompanied by S, sleet and R; consequently but little seed has been sown, and there is as little appearance of vegetation over the country as there was two months ago.

ERRATA.

THE following errata in the Monthly Tables printed in the *Meteorological Magazine* during 1878 have been discovered, by comparing them with the annual returns received from the same stations for the compilation of *British Rainfall*, subsequent correspondence with the observers having proved the amounts reported at the end of the several months to be incorrect.

REGULAR TABLE.

Maidstone (Hunton Court)	January	1·20	should be	1·26
Cirencester	January	1·25	,, ,,	1·77
Boston	August	5·31	,, ,,	5·48
Manchester (Ardwick)	February	·81	,, ,,	·88
,, ,,	March	·88	,, ,,	1·87
,, ,,	April	1·71	,, ,,	1·70
,, ,,	June	2·74	,, ,,	2·71
North Shields	May	1·89	,, ,,	1·95
Llandudno	October	3·62	,, ,,	3·78
,,	December	1·96	,, ,,	1·95

SUPPLEMENTARY TABLE.

Addington	October	2·14	should be	2·16
Langtree Wick	August	5·85	,, ,,	5·97
Mickley	February	1·43	,, ,,	1·47
Port Madoc	May	3·92	,, ,,	3·72
Gruinart	October	6·21	,, ,,	6·02
Ballinasloe	May	4·36	,, ,,	4·38

ANTICYCLONES AND FOG. (f = fog; m = mist. Extracted from the D.W. Reports.—During the anticyclones in March, fog or mist was reported as under (the names are arranged according to the height of the barometer):—During the anticyclone of March 9th, Lyons (30·56—f), Toulon (m), Cuxhaven (m), London (f), Prawle Point (m), Oxford (m), Yarmouth (m), Corunna (f), Donaghadee (m), Mullaghmore (30·29 m). On the 10th:—Lyons (30·58—f), Jersey (f), Scilly (f), Charleville (m), Prawle Point (m), Cape Gris Nez (f), London (f), Pembroke (f), Holyhead (m), Yarmouth (30·37—f). Similar conditions were shewn by the charts of March 13th, 14th, and 18th.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

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DAILY ATLANTIC WEATHER MAPS.

HAVING through the courtesy of General Myers received a set of specimens of the current publications of the United States Signal Office, and also a sufficient number of copies of the International Weather Map to enable us to issue one with each copy of this Magazine, we are in a position to resume the consideration of the above subject.*

We will first describe the various publications, and then consider whether they do or do not meet the present requirements of science, and whether they are or are not as good as can be made.

Daily U.S. Weather Maps.—These are about eighteen times larger than those issued by the English office—partly because the American ones are drawn on a much larger scale than (more than twice as large as) the English ones, and partly because of the far greater extent of the United States than of the British Isles, even with the parts of France, Spain, Italy, Germany, Denmark, Norway, and Sweden, which are included in the English maps.

They are much handsomer than the English ones, the various data being given upon each in four different colours. The land is shaded with brown according to its altitude; the seas, lakes, and chief rivers (as they should be on all maps) blue; the temperature data and the isotherms are red; and the isobars mauve. We are not sure that this plan is as instructive as the English method of four separate maps, one each for pressure, temperature, wind, and weather. Each system has its merits; but one thing is quite certain, namely, that for good looks the Americans leave our English maps hopelessly in the rear. Why cannot our maps show which is land and which is sea?

In another respect they far surpass us, because they publish maps three times daily, viz., 1 a.m., 7.35 a.m., and 4.35 p.m. We do not know why these irregular intervals of $6\frac{1}{2}$, 9, and $8\frac{1}{2}$ hours were selected, but it is of no moment, the important fact is that the in-

* *Met. Mag.* Vol. VI. p. 86, Vol. XIII. p. 117, and Vol. XIV. p. 2.

tervals are sufficiently short to enable one to trace with certainty the sequence of phenomena. The English Meteorological Office also has three observations made daily, viz., 8 a.m., 2 p.m., and 6 p.m., but the intervals, 6, 4, and 14 hours, are far more unequal, night observations being entirely omitted. To a certain extent it may be claimed that two maps are published daily, since the 6 p.m. observations are partly laid down in the little map published (for six days out of each seven), in the *Times*, the observations being made at the expense of that journal.

We think that it would be a great improvement in the United States Maps if the arrow heads were varied according to the force of the wind, as is done in the English ones.

Daily Bulletin of International Meteorological Observations.—Two years ago* we printed an article entitled "Synchronous Observations and Wasted Labour," in which, while we strongly supported General Myers' system, we pointed out the utter absurdity of sending 58 sets of British observations, while on no map of reasonable size could more than one-quarter of them be laid down. We regret to find that there is nearly the same waste of labour in the French returns as in the English ones, and as regards the vicinity of the capital it is even worse, for while the English series contains two representatives of the metropolis, viz., Kew and Greenwich, for Paris we find (1) Observatoire National, (2) Montsouris, (3) St. Maur, (4) Versailles—four stations the two most distant of which are but 16 miles apart, while two of them must be almost within one mile. The sooner steps are taken to cut down these superfluous records the better, and until this disproportion is checked we cannot swerve from our opinion that much labour is being wasted both in Europe and in America.

Along with this International Bulletin is issued the very pretty map of the Northern Hemisphere (Polar Projection), of which we have the pleasure of issuing a specimen herewith.

It is notoriously ungracious to "look a gift horse in the mouth," but honest and impartial criticism is equally obligatory upon us, no matter how courteous may be the authors whose work we have to notice. We have already said that these charts are pretty, and our readers can confirm our verdict—especially those of them who ever read "Meteorographia."

Prettiness is however one thing, and trustworthiness another—they are neither necessarily allied nor necessarily antagonistic. These charts are unquestionably pleasant to the eye, there is no need to discuss that; but we must examine to what extent they are to be trusted. Respecting the accurate representation of the weather in the United States there can be no doubt; a simple reduction from the splendid daily map issued by the office will ensure that, and for Europe also the various weather maps published by the different Govern-

* *Met. Mag.* vol. XII. p. 37.

ments would suffice, but in addition there are the 58 returns sent from the British stations, and the somewhat smaller numbers sent from the far larger countries of France, Germany, &c. We may therefore fairly conclude that for the continents of N. America and Europe the curves drawn upon these maps are nearly perfect. But what is to be said respecting the Atlantic? It is Atlantic Weather Maps for which we specially plead. Do these International ones issued by the United States Signal Office really give so accurate a representation of Atlantic Weather as to supply what is wanted? We heartily recognize the utility of these Maps of the whole Northern Hemisphere, and although we are of opinion that they do not adequately record Atlantic Weather, we should greatly regret to find that opinion misconstrued and represented as being adverse to the present charts. They are not called, and do not profess to be, Atlantic Maps, but International Maps, and we no more censure them when we say that they do not adequately represent Atlantic Weather, than we should censure the English Charts if we said that they did not adequately represent the features of Devonshire climatology. In the first place the scale of the Maps is far too small. It is not much more than one inch for a thousand miles.

In the next place the information from which the isobars and isotherms are drawn is terribly scant.

We have taken from the Bulletin upon which the accompanying map is based all the records which we can find of Atlantic pressure and temperature, and give below a list of (1) Island Stations, and (2) Ship Records; placing in a second class those of the latter of which the barometric values are doubtful either from the error of the barometer not being known, or from their being only aneroid readings :—

Islands—

Iceland, Faroe, Azores, Madeira, Cape de Verd, Bahamas, Martinique.

Ships—

CLASS I.						CLASS II.					
Lat.	51°	55′	N. Long.	6°	35′ W.	Lat.	49°	3′	N.	14°	11′ W.
	48	41		36	17		48	44		32	20
	35	42		73	54		40	47		66	45
	29	25		72	10		39	34		71	42
	6	27		22	29						

It will be seen that this leaves a square containing nearly three million square miles without a single observation.

In case this might be an unusually poor supply, we took another day hap hazard (November 19th, 1877) and, as far as we can find, the entire data for the Atlantic are from seven ships and the land stations. No one surely will argue that seven ship records are enough to represent Atlantic Weather. We do not wish to be too hard on the 58 British returns, but if any of our readers desire a little amusement they can work out the following sum :—As the area of the British Isles is to the area of the North Atlantic, so is 58 to

to the few thousand stations requisite to represent the Atlantic with equal completeness.

Joking apart, it is perfectly evident that while we yield to no one in appreciation of the many excellences of Signal Office work, we are bound to state that in this particular branch it is working without adequate materials. We must express our astonishment at the consistency of the facts represented for many consecutive days, but with such paucity of materials there is far too much room for the scientific use of the imagination.

We cannot finish our notice of Signal Office publications this month, and we do not like to leave off with remarks that sound like censure. But it is not censure; we merely say that these maps are what they profess to be—International. They are not and do not profess to be that for which we have asked, and shall continue to ask, *Daily Atlantic Weather Maps.*

EASTER AT THE SORBONNE.

In accordance with our usual custom we give abstracts of the principal communications bearing upon Meteorology read at the Easter meeting of the Délégués des Sociétés Savantes.

Variation of Temperature with Altitude.—M. Alluard, Director of the Observatory on the Puy-de-Dôme, exhibited a series of diagrams giving the daily extremes of temperature at the observatory at Clermont and at that on the summit of the Puy-de-Dôme. The curves of daily maximum temperature are usually parallel, but those of minimum temperature vary irregularly and often cross each other, both in summer and in winter; whence it appears that the temperature on the summit of the Puy-de-Dôme (4813 ft.) at night is often warmer than at Clermont (1273 ft.)—sometimes as much as 10° F.

Intermediate Station at about 3000 *ft.*—Partly with a view to a closer examination of the above-mentioned facts, and also that of others relating to variations in barometric pressure, M. Alluard has started a third station nearly intermediate in altitude to the two existing ones.

Serious Deposits of Hoar Frost on the Mountain Instruments.—M. Alluard finally called attention to the remarkable quantity of hoar frost deposited in winter on the observatory, and on the instruments, by the passing clouds. It attains a surprising thickness and its weight breaks many of the instruments and in various ways seriously impairs the utility of mountain observatories. The telegraph wire from the summit, which is less than $\frac{1}{4}$ in. in diameter, was coated with frost $\frac{1}{2}$ in. thick, and the lightning conductor, which was at a right angle with the clouds is said to have become $8\frac{1}{4}$ in. thick! Well might the arms of the anemometers be constantly broken by the weight they had to carry.

Rainfall of Spain and Portugal.—Prof. Raulin, of Bordeaux, whose works on the rainfall of France and of the Mediterranean we have often had the pleasure of reviewing, forwarded a short note upon the rainfall of Spain and Portugal, based on observations at 28 Spanish and 9 Portuguese stations, with the addition of 6 on the frontier of France. Although this number is admittedly insufficient to give a precise idea of the distribution of rain over the Peninsula, it suffices to point out its general features both as to total quantity and seasonal distribution. As regards total amount, the Pyrenees and the coast of the Bay of Biscay have mean falls ranging from 37 to 50 in., diminishing southwards along the Atlantic coast to 29 in. at Lisbon. In the Eastern Pyrenees the quantity varies from 20 to 34 in. At Gibraltar it is about 29 in. On the table-lands in the interior it varies from 16 to 24 in. The driest parts are, in the East Saragossa in the plain of the Ebro with 12 in., Albacete on the plain of Murcia with 11 in., in the centre Valladolid 13 in., and Salamanca 10½ in., Badajoz 11 in., and Seville 13 in.

A Costly Silver Thaw.—M. Duchalais, Sub-Inspector of Forests, gave an account of the effects of two silver thaws in l'Orleanais and especially in Sologne. The first, which occurred only in Sologne on January 9th, and lasted two days, was produced under the influence of a south-easterly current. The second, on the contrary, was during N.W. winds, and lasted from January 22nd to 26th. During the latter period the coating of ice became 1½ in. thick, although the rain gauge only collected 0·09 in.

After having explained its effect upon foliaged trees, he proceeded to dwell upon the injury produced in the pine forests of Sologne, which he estimated at 2,500,000 francs (£100,000).

Finally, the author called attention to the Laricio Pine as the best suited for the reforestation of Sologne, as it had best resisted the late silver thaw.

Lightning Conductors.—M. Fabre described the first case in which the system of protection applied by M. Melsens to the Hotel de Ville at Brussels has been adopted in France. The maison centrale at Nismes stands upon a rock about 100 ft. above the rest of the town. As there is no subterranean water, the ordinary earth terminals could not be obtained. Other plans were therefore necessary, and the building has been protected by a system of conductors, including two seven-pointed *aigrettes*, distributed over all the salient angles and ridges. They are iron rods a third of an inch in diameter, and are all attached to a circular conductor, which runs round the building level with the soil, and which is itself in metallic connection with the water and gas mains of the town.

Forestry.—M. Demontzey gave a brief summary of the contents of his work, entitled "Etude sur les travaux de reboisement et de gazonnement des montagnes," which has been issued by the National Printing Office. After having briefly summarized the obser-

vations made upon torrents by the numerous savants who have studied them, M. Demontzey explained the series of works of all kinds, which ensure the correction of a torrent and the reforestation of the basin whence it flows, works destined to secure its extinction both present and perpetual. After having dwelt upon the very varied qualifications which the officers of the forest service ought to possess, he insisted upon the necessity of reforestation wherever the extinction of a torrent was necessary.

The author concluded by calling attention to the fact that the reforestation of the mountains was a truly national work, inasmuch as it not only benefited the localities themselves but the public in general.

A Bolide containing Phosphorus.—Prof. Lardrey of Dijon, exhibited fragments of phosphorus obtained under the following conditions :— A person reputed to be very trustworthy, but quite ignorant of scientific matters, was passing along the main street of Marsannay-la-Côte, near Dijon, on the evening of October 18th, 1878, a bright light came behind him, and he saw something strike the middle of the street a few hundred yards in front of him. Seeing that there remained something bright on the ground, he picked up some small pieces, took them home and put them in a box, before Prof. Lardrey heard of the occurrence, nearly all the specimens had been scattered, but he obtained a few fragments, and at once hermetically sealed them in a test tube. Prof. Lardrey is so anxious to preserve these portions that he has not experimented directly upon them, but is trying to obtain phosphorus in a state as nearly resembling that of the specimens as possible.

The president (M. Milne-Edwards), reminded the meeting of the long standing mistrust respecting similar records, and called upon Messrs. Daubrée and Dieulafait of Marseilles, to offer some remarks respecting an aerolite which contained sulphur.

M. Dieulafait said, that having examined the specimen, and the conditions under which it was found, he had not thought it necessary to devote much time to the subject.

M. Daubrée expressed his opinion that the specimen which contained sulphur was not an aerolite at all.

M. Wurtz thought it very strange that phosphorus should have been found in an aerolite, as it burns at 104° F., and bolides generally arrive at the earth's surface in an incandescent state.

M. Daubrée added that not only are they incandescent, but actually reach the earth with a vitrified coating.

Observatory on Mont-Ventoux.—M. Pamard, presented a copy of a pamphlet written jointly by himself and Messrs. Bouvier and Girard to point out the desirability of establishing a meteorological observatory on the summit of Mont Ventoux. He called special attention to the very favourable conditions which it offered for such an establishment, it was easily accessible in all seasons, and one could

drive to the very summit. The premises would afford accommodation for savants, astronomers, physicists, chemists, naturalists, and medical men, who might be glad to carry on there, researches upon celestial phenomena, upon the properties and composition of the air at great altitudes, on the physics of the globe, on botany, geology or physiology.

SUPPLEMENTARY TABLE OF RAINFALL IN APRIL, 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	2·19	XI.	Port Madoc	1·55
,,	Littlehampton	3·48	,,	Douglas	2·18
,,	Horsham, Swallowfield.	...	XII.	Carsphairn	2·48
,,	Hastings, Manor House	3·43	,,	Melrose, Abbey Gate...	2·99
,,	Hailsham	3·26	XIV.	Lanark, Baronald	..
,,	I. of W., St. Lawrence.	3·44	XV.	Islay, Gruinart School..	1·12
,,	Strathfield Turgiss	3·08	XVI.	St. Andrew's, Cambo...	2·10
III.	Great Missenden	2·95	,,	Aberfeldy H.R.S.	1·80
,,	Winslow, Addington ...	2·49	XVII.	Tomintoul	...
,,	Oxford, Magdalen Col...	2·35	,,	Keith H.R.S.	2·80
,,	Northampton	2·08	,,	Forres H.R.S.	·77
,,	Cambridge, Merton Vil.	2·17	XVIII.	Strome Ferry H.R.S....	·57
IV.	Harlow, Sheering	3·91	,,	Lochbroom	·84
,,	Diss	2·21	,,	Auchnasheen H.R.S. ...	·70
,,	Swaffham	2·40	,,	Tain, Springfield	...
,,	Hindringham	1·98	,,	Loch Shiel, Glenfinnan.	2·53
V.	Salisbury, Alderbury...	2·44	,,	Dalwhinnie H.R.S.....	7·70
,,	Calne, Compton Bassett	3·20	XIX.	Lairg H.R.S.	2·71
,,	Beaminster Vicarage ...	..	,,	Altnabreac H.R.S.	1·82
,,	Dartmoor Prison	5·14	,,	Watten H.R.S.	2·08
,,	Langtree Wick	2·70	XX.	Fermoy, Glenville	4·20
,,	Lynmouth, Glenthorne.	2·17	,,	Tralee, Godfrey Place...	...
,,	St. Austell, Cosgarne...	3·37	,,	Cahir, Tubrid	3·07
,,	Taunton	2·49	,,	Tipperary, Henry St....	2·94
VI.	Bristol, Ashleydown ...	2·98	,,	Newcastle West	1·92
,,	Wem, Sansaw Hall.....	3·47	,,	Kilrush	1·98
,,	Cheadle, The Heath Ho.	2·86	,,	Corofin	2·24
,,	Bickenhill Vicarage ...	2·98	XXI.	Kilkenny, Butler House	1·55
VII.	Melton Mowbray	2·66	,,	Ballymore, Eustace ...	...
,,	Horncastle, Bucknall ...	2·19	,,	Kilsallaghan.....	1·82
VIII.	Walton-on-the-Hill.....	3·03	,,	Navan, Balrath	1·45
,,	Broughton-in-Furness ..	2·08	,,	Athlone, Twyford	...
IX.	Wakefield, Stanley Vic.	2·43	,,	Mullingar, Belvedere ...	1·55
,,	Ripon, Mickley	2·48	XXII.	Ballinasloe	1·90
X.	Gainford	1·86	,,	Clifden, Kylemore	3·69
,,	Haltwhistle, Unthank..	2·00	,,	Crossmolina, Enniscoe..	2·47
,,	Shap, Copy Hill	1·98	,,	Carrick-on-Shannon ...	1·40
XI.	Llanfrechfa Grange	3·63	,,	Dowra	1·77
,,	Llandovery	1·46	XXIII.	Rockcorry.....	1·19
,,	Solva	1·71	,,	Warrenpoint	2·35
,,	Castle Malgwyn	1·99	,,	Newtownards	1·97
,,	Rhayader, Nantgwillt..	2·60	,,	Larne, Carnlough	2·04
,,	Carno, Tybrittle	2·52	,,	Bushmills	1·33
,,	Corwen, Rhug	2·41	,,	Buncrana, Rockfort ...	...

THE DETERMINATION OF ANEMOMETER CONSTANTS.*

IN the Transactions of the Royal Irish Academy for 1850, the Rev. Dr. Robinson described his Cup Anemometer, and stated that the ratio of the velocity of the wind to that of the cups was approximately as 3 to 1.

About 20 years afterwards, an extensive series of experiments on cup anemometers, was carried out by M. Dohrandt, at St. Petersburgh, and details published in the "Repertorium für Meteorologie" Band IV. 1874. Eight anemometers of different dimensions were experimented on, five of them being tested by a whirling machine, and four by comparison with these five in the open air. A trial was also made by carrying one of the anemometers on the tender of a locomotive. The general result was to throw doubt on Dr. Robinson's rule, and to prove that the constants varied considerably in different instruments.

In 1875, Dr. Robinson read another paper to the Royal Irish Academy, in which he called in question the accuracy of the results arrived at by M. Dohrandt, chiefly on account of the whirling machine being placed in too confined a space. Great care had been taken by M. Dohrandt in measuring, and allowing for, the circular current of air carried round with the whirling machine, but Dr. Robinson doubted the accuracy of the allowance. An important admission, however, was made by Dr. Robinson, in this paper, viz.—that he had been in error in stating that the ratio of the velocity of the wind to that of the cups was independent of the size of the instrument.

In the "Repertorium für Meteorologie" Band VI. 1878, the results of a further elaborate series of experiments by M. Dohrandt are published. The same whirling machine as before was employed, but considerable improvements were introduced, such as moving the machine by an hydraulic motor — using electrical registration throughout, &c. Experimental anemometers were also tried of various dimensions to test the effect of variations in length of arm and size of cups. The final conclusions arrived at were as follows:—

"In conclusion I will express my opinion, as far as concerns the Robinson's cup anemometers, with reference to the question No. 23 of the programme of the 2nd National Meteorological Congress which was held in September, 1877, at Rome, viz.:—'How are absolute values for the velocity of the wind to be obtained from the direct readings of the usual anemometers?'

"(1). The deduction of the *absolute* values of the velocity of wind from the readings of the anemometers must be given up as long as the usual practice of verification is adopted by moving the anemo-

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* Bestimmung der Anemometer-Constanten (Fortsetzung), von F. Dohrandt. St. Petersburg, 1878.

meters with a given speed against still air without ascertaining by exact experiment whether the pressure of the air moving against a body at rest is really equal to the resistance which the body experiences when moving with equal velocity against still air; or, should there be a difference between the pressure in the two cases, what that difference is. On the other hand, anemometers verified according to the previous method enable the velocity of the wind to be expressed on a uniform scale, and thus enable the wind observations in the most different places to be compared with the greatest strictness.

"(2). Dr. Robinson's rule, according to which the centres of the cups, independently of the dimensions of the anemometer, move with one-third of the velocity of the wind, is inaccurate, and will generally lead to too high velocities of wind. Indeed, under certain conditions, this rule may make the velocities of wind arrived at from a verified anemometer nearly 30 per cent. too high (compare $B_2 = 2{\cdot}2002$ instead of the value given by Dr. Robinson, $B_2 = 3{\cdot}00$, page 25).

"(3). The relation of the velocity of the centre of the cups to the velocity of the wind is dependent on the dimensions of the anemometer. If r signifies the distance of the centre of the cups from the axis of revolution, and R the radius of the cups of the anemometer, of ordinary and not too exceptional dimensions, then the relation (B_2) of the velocity of the anemometer to the velocity of the wind will be calculated with an average error of $\pm$ 3% by the following expressions:—

$$B_2 = \alpha_1 + \beta_1 \frac{R^2}{r} + \gamma_1 \frac{R^4}{r^2}*$$

in which $\alpha_1 = 3{\cdot}0133 \quad \beta_1 = -53{\cdot}7367 \quad \gamma_1 = 1033{\cdot}81$

"(4.) The derivation of the second anemometer-constant from the dimensions can only be looked upon as a make-shift, where it is not practicable to test the anemometer by direct trial.

"(5.) For the direct verification of the anemometers, the Combes revolving apparatus is advantageous for many reasons. The arrangement of the revolving apparatus erected at the Physical Central Observatory at St. Petersburgh, together with the arrangements for putting it in motion, and for registration, must be looked upon as patterns; only it is desirable that such an apparatus should be erected in as large an enlcosed space as possible. The following rules are applicable for testing the anemometers.

"(*a.*) The anemometer must be tested with its axis in a vertical position, in the two opposite directions of revolution, and at somefive different, tolerably equidistant, velocities.

* This is an empirical formula in which α_1 β_1 γ_1 are experimental constants.

"(*b.*) The amount of the air which moves round with the apparatus during its rotation in an enclosed space (the 'vortex') must be measured and be deducted from the observed velocity of rotation (it is desirable that all anemometers to be tested should register electrically).

"(6). Anemometers of equal dimensions and from the same manufactory have such uniform constants, that as a rule it is sufficient when one of them is tested to treat its constants as applicable to the other similarly constructed anemometers.

"(7). The constants of stationary anemometers of large dimensions —anemographs—can be deduced with great exactness by lengthened comparison with tested anemometers in the open air; in doing this it is necessary that during the trial, winds of as different as possible velocity should be blowing.

"(8.) The anemometer formulæ which express the relation of the registration *(n)* to the velocity of the wind *(v)* must in general have three constants, and when the velocities are calculated according to the following formulæ :—

$$v = a + bn + cn^2$$

shew only slight variations from the observed values. Also, the reduction table, which must be prepared for each anemometer, should be calculated with three constants.

"(9.) The anemometer formulæ, with three constants, even enable velocities of wind which are considerably above the maximum velocities reached during the trial, to be calculated with great probability (for instance, in the anemometers tested in the present trials velocities of some 70 kilometers an hour).

"(10.) Experiments point to the conclusion (compare anemometers 8 and 9, p. 17) that a certain relation exists between the length of the arms and the radius of the cups at which the third member of the anemometer formulæ disappears, and then a linear function expresses the relation of the registered units to the velocity of the wind. Anemometers of this kind would be specially advantageous for the 'Wind-component Integrator.'

"(11.) Anemometers of small dimensions, and with small frictional resistance, are very constant in their action (compare anemometer Schultze No. 5, p. 7), and seldom require to be regulated after they have once been tested. For anemographs, the construction of which necessitates a great and at the same time variable amount of friction, frequent verification is necessary."

THIRTY WINTERS.

To the Editor of the Meteorological Magazine.

SIR,—I hope you will not be frightened by the annexed table. It is a record of 30 years' winters, amongst which the winter which is still raging is quite singular. I cannot get at any satisfactory data for supporting my theory that cold winters are followed by cold summers, as four hot summers followed winters below the average; but some winters of very high average led up to the broiling seasons of 1868, 69, 70, and 1871. The feature of this winter is the low temperatures of December and January; if we had scored a few sensational frosts, which we did not, it would have been more extraordinary still.—Yours truly, W. LUCAS.

YEARS.	Nov.	Dec.	Jan.	Feb.	March	April.	Average.	Summer.
	°	°	°	°	°	°	°	
1849-50 ...	41·5	37·0	32·3	42·3	38·1	47·8	39·8	hot
1850- 1 ...	44·0	38·8	40·5	38·2	40·8	44·5	41·1	medium
1851- 2 ...	35·0	37·5	38·5	38·0	38·5	43·0	38·5	hot
1852- 3 ...	45·3	45·0	40·0	32·1	38·5	43·1	40·3	medium
1853- 4 ...	40·6	32·6	33·9	35·1	38·0	43·0	37·2	hot
1854- 5 ...	38·9	38·9	34·0	27·0	38·0	44·5	36·9	medium
1855- 6 ...	39·2	33·6	37·0	40·3	37·5	45·5	38·9	medium
1856- 7 ...	38·8	38·2	33·6	37·7	41·1	44·3	39·0	hot
1857- 8 ...	43·7	42·3	35·5	34·0	40·1	44·8	40·0	hot
1858- 9 ...	36·5	37·1	37·2	39·0	44·0	44·1	39·6	hot
1859-60 ...	38·9	34·5	36·5	32·6	39·7	41·3	37·1	cold
1860- 1 ...	38·5	32·2	31·3	39·0	41·3	39·0	36·9	cold
1861- 2 ...	37·7	36·7	36·5	39·0	41·7	46·8	39·8	cold
1862- 3 ...	35·8	40·4	38·2	39·6	41·2	47·0	40·3	cold
1863- 4 ...	42·7	39·9	33·7	34·4	39·4	47·0	39·3	coldish
1864- 5 ...	39·4	35·7	33·6	34·3	35·0	50·4	38·0	medium
1865- 6 ...	42·1	46·6	41·0	39·5	40·6	47·7	41·9	medium
1866- 7 ...	42·1	40·9	32·7	42·5	36·0	48·1	40·3	medium
1867- 8 ...	39·6	35·0	35·8	41·5	42·1	47·0	40·1	hottest in our record
1868- 9 ...	39·2	44·1	40·8	45·1	38·1	50·7	43·0	very hot
1869-70 ...	42·5	37·5	37·4	34·5	38·3	47·0	39·5	very hot
1870- 1 ...	39·3	30·9	31·3	41·0	43·1	47·3	38·7	very hot
1871- 2 ...	35·0	36·0	38·5	42·3	43·0	46·0	40·1	hot
1872- 3 ...	42·1	39·0	38·3	32·9	39·3	44·2	39·2	medium
1873- 4 ...	40·3	37·2	38·2	35·6	40·8	47·7	39·9	hot
1874- 5 ...	38·5	29·2	40·0	32·1	37·8	43·7	37·0	cold
1875- 6 ...	38·5	35·5	33·0	38·1	37·7	44·0	37·9	hot
1876- 7 ...	39·9	39·6	37·9	39·2	37·1	42·9	39·2	cold
1877- 8 ...	40·5	36·3	37·5	40·0	39·9	46·5	40·1	medium
1878- 9 ...	36·9	31·0	28·9	36·0	39·1	41·1	35·3	
MEAN	39·8	37·1	36·1	37·4	39·5	45·0	39·1	

Hitchen, May 4th, 1879.

From the above table it will be seen that the temperatures of the last six months have been the lowest for thirty years with the ex-

ception of 4 colder Novembers, 2 colder Decembers, 11 colder Februarys, 13 colder Marchs, and 1 colder April—January and the average for the six months are without precedent.

THE WEATHER IN APRIL.

The weather at the beginning of the month was very quiet generally. From the 1st to the 5th very uniform pressures were reported, and very light variable airs with fair weather prevailed. On the 5th the barometer rose fast over North Germany, but was falling briskly in the W., and gradients for S. winds were once more being formed over these Islands, the weather becoming dull, rainy, and unsettled.

Very unsettled weather prevailed during the whole of the second week. During the first few days a rather important depression lay over our western coasts, causing strong winds and gales from S., with overcast skies, but moderately warm weather. This depression continued with but little change in its position until the night of the 8th, but owing to a brisk rise of the bar. in Scandinavia, rather steep gradients for S.E. winds were formed in the N.E., and slight S.E. gales were experienced in Scotland. On the 9th the disturbance passed south-eastwards over the Netherlands, and E. breezes extended further southward, and from that time to the end of the week the highest pressures remained steadily in the N.; fresh E. winds were experienced with cold, inclement weather and frequent falls of snow and sleet.

The changes during the third week were both gradual and irregular. For the first few days pressure was highest in the N., and a depression appearing off our S.W. coasts, E. to N.E. breezes (light to moderate in the N., but fresh to strong in the S.) prevailed on our coasts, with dull, cloudy, cool weather, and some rain. As this disturbance passed off to the eastward, the wind became N. and N.W., and temperature rose somewhat. On the evening of the 17th another change occurred. The mercury fell a little in the South of Ireland, and a band of high pressure was thus formed over Great Britain, while a well-marked depression lay over the Baltic, and another approached the South of Ireland. The band moved slowly eastward over the British Isles during the next few days, bringing very fine weather, but as the depression in the W. continued to increase, very unsettled weather followed, with rain and S. winds, strong to a gale in force.

During the greater part of the fourth week weather was in a very unsettled state. On the 20th a depression lay over Ireland, and E. breezes prevailed everywhere, the north excepted, and W. winds in the south, while the barometer fell briskly generally. On the next day pressure began to increase steadily in the north, while a large depression was shown over the south of the British Islands and France. This depression passed off eastwards and from that time till the close of the week the track of the several disturbances was from N.W. to S.E., so that the prevailing winds were from S.W. to N.W. in the south-west, and from S.E. to N.E. in the north, while in the intervening space the winds varied considerably according to the position of the different cyclones. On the 29th, (by which time these disturbances) had passed away travelling in a south-easterly direction), the barometer rose over the whole of Western Europe. Readings were high and uniform over the British Islands, while areas of low pressure were shown over the southern part of the Baltic, and in the neighbourhood of Genoa. The weather at the same time became fine and dry.

Rain was frequent during the month, but not heavy, except on the 8th, 9th, and 10th, when the amounts reported from some parts of this country and Scotland were large.

H. E. M.

Winter Temperatures in Stevenson's Stands, 1878-79.

Stations.	November.					December.					January.					February.					Summary of 4 Months.				
	Extremes.		Mean Daily.			Extremes.		Mean Daily.			Extremes.		Mean Daily.			Extremes.		Mean Daily.			Extremes.		Mean Daily.		
	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean	Max.	Min.	Max.	Min.	Mean
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Jersey	55·2	34·9	48·9	40·9	44·9	54·6	27·5	44·7	36·1	40·4	52·6	25·0	40·9	34·5	37·7	52·8	30·4	46·9	38·5	42·7	55·2	25·0	45·3	37·5	40·4
Babbacombe ...	52·9	31·0	46·1	37·0	41·6	52·8	20·6	41·9	31·4	36·7	52·8	19·1	39·8	32·6	36·2	53·9	28·2	46·7	36·8	41·8	53·9	19·1	43·6	34·5	39·1
Ventnor	52·3	31·8	46·2	37·5	41·8	50·7	24·1	42·0	32·8	37·4	49·2	22·2	38·8	32·5	35·6	50·3	26·1	44·0	36·1	40·0	52·3	22·2	42·7	34·7	38·7
Torquay	52·7	30·9	45·8	36·3	41·0	52·7	19·7	41·6	31·2	36·4	51·7	19·5	39·4	31·9	35·6	53·7	27·6	45·8	36·1	41·0	53·7	19·5	43·2	33·8	38·5
Worthing	53·0	31·4	46·0	36·5	41·2	49·8	21·0	40·1	30·9	35·5	49·3	19·7	38·3	30·4	34·3	47·0	26·4	41·9	35·0	38·4	53·0	19·7	41·6	33·2	37·3
Barrow	51·0	27·0	44·9	34·7	39·8	47·0	16·0	38·0	28·3	33·2	45·0	20·0	36·4	28·4	32·4	45·0	28·0	41·9	33·4	37·6	51·0	16·0	40·3	31·2	35·8
Addiscombe ...	52·5	28·1	44·3	35·1	39·7	55·3	11·4	37·6	29·0	33·3	50·9	18·3	35·6	28·0	31·8	52·7	20·9	42·8	34·4	38·6	55·3	11·4	40·1	31·6	35·8
Isleworth	53·5	27·5	44·6	34·1	39·3	54·8	8·8	38·2	27·6	32·9	48·3	10·8	35·8	27·7	31·8	54·1	10·5	43·0	32·8	37·9	54·8	8·8	40·4	30·5	35·5
Watford	50·9	25·6	44·4	33·9	39·1	54·7	8·8	37·4	27·4	32·4	47·0	15 2	34·2	26·3	30·2	52·3	20·4	41·8	33·9	37·8	54·7	8·8	39·4	30·4	34·9
Hodsock Priory	49·7	24·7	43·4	32·6	38·0	53·1	9·8	37·6	25·5	31·5	47·8	6·3	36·0	24·8	30·4	60 2	17·7	41·5	32·2	36·9	60·2	6·3	39·6	28·8	34·2
Addington	51·0	27·0	43·0	33·0	38·0	52·0	5·0	35·0	25·0	30·0	46·0	11·0	34·0	23·0	28·5	54·0	18·0	41·0	32·0	36·5	54·0	5·0	38·3	28·3	33·3
Cockermouth ...	47·7	23·0	42·8	32·3	37·6	48·0	6·1	34·4	22·0	28·2	47·6	14·6	36·3	25·4	30·8	48·0	21·6	41·3	31·9	36·6	48·0	6·1	38·7	27·9	33·3

REMARKS.—*Jersey, St. Aubin's School*, 139 ft. above sea. J. E. Vibert, M.A.—*Babbacombe*, 294 ft. above sea. E. E. Glyde, F.M.S.—*Ventnor, Consumption Hospital*, 150 ft. above sea. E. Mawley, F.M.S.—*Torquay, Rocombe*, 400 ft. above sea. H. Hearder, F.M.S.—*Worthing*, 21 ft. above sea. W. J. Harris, M.R.C.S., F.M.S.—*Barrow*, 60 ft. above sea. F. Slade, C.E.—*Croydon, Addiscombe*, 202 ft. above sea. E. Mawley, F.M.S.—*Isleworth*, 64 ft. above sea. E. A. Ormerod, F.M.S.—*Watford, Wansford House*, 324 ft. above sea. J. Hopkinson, F.L.S., F.M.S. — *Worksop, Hodsock Priory*, 67 ft. above sea. H. Mellish. — *Winslow, Addington*, 309 ft. above sea. J. Mathison.—*Cockermouth*, 144 ft. above sea. H. Dodgson, M.D., F.M.S.

APRIL, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which .01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	2·72	+ 1·59	·53	9	16	61·7	26	26·8	12	7	12
II.		Maidstone (Hunton Court)	2·85	+ 1·70	·46	23	15	...	...	...	...	...	...
,,		Selborne (The Wakes)	3·29	+ 1·79	1·11	6	17	58·5	26	22·0	29	10	16
III.		Hitchen	2·33	+ 1·33	·39	6	18	56·0	26	26·0	11	12	...
,,		Banbury	3·01	+ 1·85	·58	6	20	57·5	26*	26·0	13	13	...
IV.		Bury St. Edmunds (Culford)	2·68	+ 1·93	·95	12	19	62·0	26*	23·0	11	11	16
,,		Norwich (Sprowston)	...	...	...	...	...	...	...	...	...	...	...
V.		Bridport	2·98	+ 1·50	·71	6	17	...	...	...	...	...	...
,,		Barnstaple	2·37	+ ·36	·54	26	15	62·0	28†	27·0	12	...	...
,,		Bodmin	3·49	+ 1·79	·80	19	17	58·0	27‡	26·0	12	3	14
VI.		Cirencester	3·11	+ 1·82	·66	6	18	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	2·49	+ 1·34	·40	9	17	56·0	26	23·0	13	12	17
,,		Tenbury (Orleton)	2·96	+ 1·42	·46	6	20	57·8	27	23·8	13	12	17
VII.		Leicester (Town Museum)	2·11	...	·49	14	18	57·9	26	28·5	22	8	24
,,		Boston	2·25	+ 1·28	·52	9	17	60·0	7	29·0	4	6	...
,,		Grimsby (Killingholme)	2·04	...	·30	26	18	57·0	25	30·5	13	1	...
,,		Mansfield	2·67	...	·51	9	19	58·5	7	26·0	13	7	12
VIII.		Manchester (Ardwick)	...	...	...	...	...	...	...	...	...	...	...
IX.		York	1·50	+ ·40	·30	8	16	61·5	26	26·0	13	9	...
,,		Skipton (Arncliffe)	2·52	— ·52	·47	23	18	...	...	...	...	...	...
X.		North Shields	2·35	+ 1·04	·57	7	18	54·7	2	29·0	13	3	5
,,		Borrowdale (Seathwaite)	4·76	+ 2·14	1·38	5	13	...	...	...	...	...	...
XI.	WALES.	Cardiff (Crockherbtown)	2·64	...	·73	19	17	62·0	27	30·0	12	4	...
,,		Haverfordwest	3·22	+ 1·36	1·12	7	13	57·2	26	25·0	11	9	16
,,		Aberdovey	...	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	1·49	— ·01	·44	20	14	55·7	25	30·0	13	2	...
XII.	SCOTLAND.	Cargen	1·34	— ·50	·34	5	10	56·0	26	27·8	19	7	...
,,		Hawick (Silverbut Hall)	1·61	...	...	...	17	...	...	...	...	...	...
XIV.		Annanhill	·91	...	·24	25	13	55·7	27	26·4	13‖	6	14
XVI.		Kilmory	...	...	...	...	...	...	...	...	...	...	...
,,		Mull (Quinish)	1·82	...	·39	6	11	...	...	...	...	...	..
,,		Loch Leven	2·50	+ ·98	·60	8	12	...	...	...	...	...	...
,,		Tyndrum (Ewick)	...	...	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	2·11	+ ·92	·54	7	11	52·0	1, 4	31·0	17	3	...
,,		Braemar	2·10	+ ·70	·55	7	14	51·3	26	23·8	3, 4	12	23
XVIII		Aberdeen	3·53	...	1·39	7	20	53·5	4	30·3	19	3	13
,,		Portree	1·58	— 3·69	·30	5	10	...	...	...	...	...	...
,,		Inverness (Culloden)	1·67	+ ·20	·75	17	8	53·7	5	28·0	13	7	18
XIX.		Dunrobin	1·92	+ ·68	·71	7	12	52·0	4	28·0	3	4	...
,,		Sandwick	1·70	— ·04	·61	7	15	48·8	6	29·4	16	3	19
XX.	IRELAND.	Cork	2·42	...	·90	19	10	...	...	...	...	...	...
,,		Caherciveen Darrynane Abbey	5·02	...	1·26	19	17	...	...	...	...	...	...
,,		Waterford	2·37	+ ·14	·61	19	16	60·5	25	30·0	12§	7	...
,,		Killaloe	2·22	+ ·09	·40	5	16	68·0	29	26·0	2	9	...
XXI.		Portarlington	2·02	·00	·52	23	22	59·5	25	28·5	12	7	...
,,		Monkstown, Dublin	2·04	+ ·40	·37	7	16	..	...	...	...	...	...
XXII.		Galway	2·45	...	·75	19	19	59·0	30	29·0	3	6	...
XXIII		Waringstown	1·65	...	·34	7	14	61·0	26	25·0	2	9	15
,,		Edenfel (Omagh)	2·32	...	·73	7	15	56·0	26	25·0	2	14	...
,,		Ballyshannon	...	...	...	...	...	...	..	...	...	...	...

* And 27. † And 30. ‡ And 28. ‖ And 18. § And 13, 18.

+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON APRIL.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

SELBORNE.—A bleak cold unhealthy month; much typhoid fever and pulmonary disease. Wind mostly N.E. or N.W. S on 12th, 13th, and 14th, Swallows first seen on 17th; cuckoo first heard on 22nd.

HITCHEN.—S on the 12th.

BANBURY.—S daily from 11th to 15th; high wind on 6th and 9th.

CULFORD.—April was an exceedingly cold and wintry month. The heaviest fall of S in 24 hours, for at least the last 30 years, occurred on the 12th, yielding ·95 in. of water. Mean temp. 42°·2; and polar winds prevailed during 15 days. Cuckoo and nightingale first heard, and swallows first seen on 22nd; S on 11th, 12th, and 13th; TS with H on 15th.

BODMIN.—Mean temp. 48°·3; 2°·4 below the average. S on 12th and 13th.

CIRENCESTER.—S on the 11th, 12th, and 13th

SHIFNAL.—A cold ungenial month; S during the month yielded ·74 in. Easter day (13th) the coldest for at least 45 years, min. temp. 23°, max. 40°, mean 36°; the next coldest 1836 (April 3rd), min. 32°, max. 44°, mean 38°. The max. temp. of the month was only 56°. Winds N. and N.E. with few exceptions, and bar. most spasmodic throughout. Distant T in S.E. on 26th, and again on 30th. Vegetation at least three weeks behindhand; asparagus only just peeping on 30th; throstle first heard on 2nd; coltsfoot in flower and first humble bee on 4th; rooks building on 6th; sand martins returned on 14th; cuckoo first heard on 22nd; first swallow seen on 23rd; first white and first tortoiseshell butterflies both seen on 29th; S from 11th to 15th.

ORLETON.—A very cold and cloudy month, with very little sunshine and the wind generally from N. and E. S on ground from 12th to 15th. Mean temp. nearly 6°·5 below the average, and lower than that of any other April for 24 years. Chiff-chaff seen on 1st; swallows on 17th; and cuckoo heard on 20th. No fruit trees in flower by 30th. T heard on 1st and 2nd, and a storm of L and T on 26th.

LEICESTER.—S daily from 11th to 14th.

KILLINGHOLME.—Another month of wintry weather and polar winds; vegetation very backward, giving painful recollections of the disastrous year 1860. Corn sowing is almost if not quite finished, and the state of the arable land is favourable. Grass very scarce. First swallow seen on 21st; cuckoo heard on 30th. TS with H and R on 26th.

MANSFIELD.—S on 12th and 14th.

YORK.—Mean temp of month, 43°·5; in 1878 it was 47°·4, and in 1877 43°·2. S on three days.

ARNCLIFFE.—S at the end of the month.

NORTH SHIELDS.—S from 11th to 15th and on 17th.

SEATHWAITE.—The month was very cold and dry, with the wind generally in the E. There was only one day on which the fall exceeded 1·00 in., and the total for the month is considerably below the average.

WALES.

HAVERFORDWEST.—S on 11th, 12th, and 13th. Much very cold wind.

LLANDUDNO.—The month began and ended fine, but was snowy and stormy in the middle. Mean temp. exceptionally low, being more than 5°·5 below the average, though there were only two nights of frost. Vegetation late; swallows seen on 11th; cuckoo heard and seen on 28th.

SCOTLAND.

CARGEN.—Easterly winds prevailed on 24 days. Vegetation generally about a month behindhand.

HAWICK.—Very little sun during the month, and an unusual amount of S and H. All wild flowers very late.

ANNANHILL.—A considerable amount of frost was recorded during the month. Rainfall was slight and ozone scarce, this latter being attributable to the great continuance of easterly winds, these being the prevailing winds during the month, and usually moderate to fresh breezes. S fell on the 12th, 13th, and 14th, and H on the 12th. Skies were generally cloudy, the prevailing species of cloud being the cumulus and cumulo-stratus.

QUINISH.—1st to 9th cold and wet, 10th to 30th bright sun with cold E. and N.E. winds, except on 25th, when there was warm R from S. Very low temp. and backward spring, R much needed.

ABERDEEN.—A dull, cold, wet month, with much fog. Mean temp. 41°·2, 2°·6 below average of 22 years. Rainfall 1·35 in. above 22 years average; H on 12th, 15th, and 17th; fog on 7 days.

PORTREE.—An unprecedentedly cold month, with strong frosts and N. winds. Grass and shrubs quite brown. Sheep suffering much, especially ewes and young lambs.

CULLODEN.—Vegetation very backward, but promise of an abundant fruit crop. All early spring flowering plants very late.

DUNROBIN.—Cold E. winds most of the month, and consequently vegetation made no perceptible progress. High tide and easterly winds on 7th and 8th did considerable damage on east coast.

SANDWICK.—April was remarkably cold: the ther. on grass falling below 32° on 19 nights, while in April 1878 it only occurred on 7. The days were frequently fine, though cold, and so dry as to allow agricultural operations to be carried on, and the seed sown, but vegetation is very backward. May, however, commences more favourably; but those who were early in search of May dew would find it in a frozen state. Bright aurora on 19th.

IRELAND.

DARRYNANE ABBEY.—A cold ungenial month, but with some very fine days. Vegetation made very little progress till the last week. Cuckoo heard on 25th; swallows seen on 29th. S on Easter Sunday (13th), but not enough to yield ·01 in.

KILLALOE.—Cold and very backward up to 20th, with frequent frost; mean temp. more than 3° below average. Some milder days with R towards the end of the month, gave a more spring-like appearance to the country; but cold winds and sharp frosts returned on May 2nd. Prevailing winds E. and N.E.

PORTARLINGTON.—S on 12th, 13th, and 14th.

MONKSTOWN.—A very variable month, with much cold wind, but some warm days. Heavy snow on 13th.

WARINGSTOWN.—Unusually cold; deep snow on morning of Easter Sunday.

EDENFEL.—The weather of the entire month, whether wet or dry, was uniformly cold and inclement, and there was not one that could be called a "growing day"; as a result, the hedges are still brown, and vegetation in general is three weeks behind time. No summer visitants except a few stray swallows.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLXI.] JUNE, 1879. [PRICE FOURPENCE. or 5s. per ann. post free

METEOROLOGICAL BIBLIOGRAPHY.

The receipt of a copy of the *Catalogue des ouvrages d'Astronomie et de Météorologie qui se trouvent dans les principales Bibliothéques de la Belgique* is of itself ample justification for our returning to the subject of Meteorological Bibliography, upon which we dwelt fully in our March number. But even without M. Houzeau's work we should not have hesitated to bring the subject again to the front. One thing after another comes forward and shows that there is far too little real serious thought given to meteorology. Just at present the question of anemometer constants is being really deeply considered by several able men, but why have tens of thousands of pounds been expended on the construction and erection of anemometers before definitely ascertaining what their indications meant? Moreover, why has no effort been made to secure uniformity in their exposure? We have seen perhaps from fifty to a hundred anemometers in different parts of the British Isles, but we cannot recollect *two* which are similarly erected. Now, if anything will lead people to think, it surely must be books, but indiscriminate reading is of little profit. The time has passed in which universal geniuses were possible, and now he who would aid in constructing the temple of science must be content to spend all his life in perfecting a single stone. The time of the universal genius has gone, and that of the specialist has come. Unfortunately, their number is far too small, but even in this country we may claim four or five men respected all over the world who have won their position solely by concentrating all their powers on a single subject, and while gaining honour for themselves have pushed those subjects, both as to modes of observation and accuracy of knowledge, far in advance of all others.

Whether a man aspires to becoming a colonel of the meteorological army, or merely a lieutenant, it is equally necessary that he be thoroughly acquainted with all the existing literature upon the branch to which he devotes himself; for this purpose classified catalogues are indispensable, and thus we are brought back to the consideration of the work before us.

We most heartily congratulate M. Houzeau, firstly upon the extremely happy design of his catalogue, and secondly upon its successful completion.

Belgium, as our readers are aware, is not a large country; it is much smaller than Ireland, and is well provided with railways. When making arrangements for issuing a new edition of the catalogue of the library of the Royal Observatory, he fortunately thought that it would be still better to issue a general catalogue of all the astronomical and meteorological works in all the public libraries in the country. The work before us is the realization of this happy thought. Each of the public libraries has initial letters assigned to it, such as A.M., Académie de Médecine; V.Y., Ville d'Ypres, &c.; and at the end of each title we find these letters, thereby indicating in which library the work is to be found—*e.g.*, the first title in meteorology is as follows:—

"3074 || **Grellois**, E. Plan d'une bibliographie météorologique. Paris, 1865; in 8vo.—A.R."

the interpretation of which is, that 3074 is its reference number in this catalogue; || denotes that it is an extract from some periodical publication; then follows the title, &c.; and, finally, A.R., showing that only one copy existed in a public library in Belgium, and that that one was at the Académie Royale. We need not point out either the benefit of thus concentrating in a single volume a catalogue of the entire astronomical and meteorological resources of the country, or the difficulty of carrying such a scheme to a successful issue. However, it is done, and we congratulate M. Houzeau on its accomplishment, and are certain that he has earned the gratitude, not of Belgians alone, but of earnest workers of all nations.

We await with some anxiety Mr. Scott's communication to the Meteorological Society on June 18th, respecting the proceedings at the late Congress at Rome. The notice in *Nature* of May 15th is so worded as to be absurd. It says:—

> "The preparation of a catalogue of existing meteorological literature, including papers in periodicals, was recommended, such catalogues having already appeared at Brussels and in London (for the library of the Meteorological Society)."

Here we have the whole subject in a fog again. It is perfectly clear that whoever wrote that paragraph had neither read Dr. Hellmann's article in the *Zeitschrift*, nor the translation of it, and the commentary upon it, which appeared in our March number. *That* would not be a serious matter, but it *is* serious if the assembled delegates have not discriminated between a "catalogue" and a "subject index," between that which could easily be done, and that which, although we hope to see it, is so great an enterprise that Dr. Hellmann thinks it "must ever remain something to be wished for."

The foregoing paragraph leads to a lot of questions. If the catalogue is to include "papers in periodicals," it immediately becomes

the "subject index," for who is to define the length of a communication which will justify its insertion in the list—*e.g.*, the very article in *Nature*, whence this paragraph is quoted, is of at least equal interest with the following, which we find in the Brussels catalogue :—

"3343 || **Poey**, A., **Le Verrier**, U.J., et **Faye**, H. Appel aux nations hispano-américaines. Paris, 1864 ; in 4to.—E.G."

If we may change the word "in" and write "papers from periodicals," the paragraph would at once become both true and reasonable. For then it would merely affirm the desirability of one general catalogue being compiled upon the model of Struve's, the Meteorological Society's, and M. Houzeau's. If, however, the Congress arrived no further than at recommending it as desirable, we do not think that any work will appear which will meet our expectations, or, rather, which will come up to our idea of what is desirable and possible.

For the purposes for which they were designed, we do not believe that better arranged catalogues could be prepared than the London and Brussels ones, but they are terribly incomplete ; we doubt if both together they contain one quarter of the existing works upon meteorology.

We have heard something of a proposal that every body which publishes a catalogue should send two copies to every other similar body, so that every body shall be able to cut them up and perfect its own catalogue by inserting cuttings from the others. That would be a terribly wasteful way of preparing a general catalogue—of course we do not mean wasteful in cutting up a few catalogues, but wasteful of labour, for each institute would have to do that which could be better done by some one body on behalf of all. Suppose there are twenty such bodies, it would cost each of them *in time* and materials at least £100 to make a complete concentration of the data given by the twenty catalogues which each would have to incorporate with its own. But twenty times £100, or £2000, would be ample to cover the cost of a perfect printed catalogue, of which there could be plenty of copies handy for reference, instead of the twenty bulky volumes of extracts which the same sum (not concentrated) would alone produce.

We adhere to the proposal in our previous number, and reprint it so as to secure its perusal.

We think that the first step should be to urge the Director of each Central Institute to print a catalogue of its own library. If they could be induced to do so in duplicate, *i.e.* both grouped in subjects and under authors, so much the better ; but at any rate under subjects. It is difficult to believe that this can be refused. It may also be hoped that the *Société Météorologique de France* and the *Scottish Meteorological Society* will follow the lead of the *Meteorological Society*. The Society of Telegraph Engineers have in the press the catalogue of the celebrated Ronalds Library (Electricity, Magnetism, and Meteorology). We should thus obtain about a score of catalogues, each very useful in its own country, and collectively containing probably 90 per cent. of the titles

of all meteorological works ever written. The compilation from these of one general catalogue of meteorological books and memoirs would be very easy, and the cost insignificant.

It is a legitimate subject for discussion whether this general bibliography should be grouped according to subjects or to authors. or to both. We believe, as we have already said, that for the use of persons consulting a specific library, or set of libraries, the subject grouping is best; but for the "general meteorological bibliography" we are inclined to recommend grouping under author's names, if we cannot get it in both forms.

Such a work could be prepared within six months after whoever was charged with its compilation received the whole of the separate catalogues, and whatever country might undertake it, it ought to be, and surely would be, cheerfully repaid the bulk of its outlay by the sale to other countries of copies of the work. We think that the work is so desirable that that country which was foremost in promoting it would show the highest appreciation of its mission. Certainly among the masses of meteorological literature hitherto published there is not a single work which is of half the utility which a general bibliography would be.

To epitomize—(1) We think that the compilation of the "subject index" should not be attempted yet; (2) We ask some country—and right gladly should we hear that our own Meteorological Council would do it—*(a)* to endeavour to induce all the Meteorological Institutes in the world to print catalogues of their own libraries; *(b)* to incorporate the whole of these, and any further titles which they can obtain, in one "General Meteorological Bibliography."

AN AMERICAN STORM.

"A terrific cyclone crossed Eastern Kansas on Friday evening, May 30th, killing more than 50 people, injuring over 100, and destroying much property. The storm moved from west toward east, the chief damage occurring in Marshall County, along the line of the Union Pacific Railway for a distance of 30 miles, beginning 90 miles west of the eastern boundary of Kansas. At Irving 12 people were killed and 40 were wounded, and nearly the entire town was destroyed; at Delphos, 15 people were killed; at Frankfort, 8 were killed and 13 wounded; at Blue Springs, 3 were killed; at Beloit, 3 were killed, and at Fulton 9 were killed. The iron railway bridge over the Blue River was blown to pieces, its rods and girders being twisted like wires. The cyclone is described as a dark, funnel-shaped cloud, moving about ten miles per hour just above the earth with a whirling motion, estimated at from 60 to 100 miles per hour. The path traversed varied from 300 to 700 yards wide, being distinctly marked, as every tree, house, fence or obstruction along it was destroyed."—*Telegraphed to the Times.*

TRINIDAD RAINFALL.

[Accurate rainfall observations from the West India Islands (except Barbados and Jamaica) are so rare, that having just received the following table from Mr. Prestoe, we reprint it, with much pleasure. The fluctuation in the annual total is very nearly of the usual amount, viz.—32 per cent., so that the maximum is very nearly double the minimum. There are slight errors either in the monthly or annual values in several years, but they are too small to affect the utility of the table or to justify us in delaying its publication. The most serious is 1871, of which the sum of the months is 75·58 in. We think that January, 1878, ought to be 4·43 in.—ED.]

Annual Rainfall, 1862-1878—*St. Ann's Observatory, County of St. George, Trinidad.*

YEAR.	JAN.	FEB.	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCTOBER	NOV.	DEC.	Total Rainfall in each year.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1862	...	·66	·77	·25	1·41	8·47	10·36	9·57	11·97	6·60	10·06	3·08	63·23
1863	1·54	2·71	1·45	·85	1·26	9·12	10·12	10·53	12·11	6·24	4·30	6·57	66·83
1864	2·51	·53	·36	·04	8·15	4·96	7·17	12·06	8·04	6·53	5·94	6·61	62·90
1865	2·62	3·20	1·07	7·98	3·22	5·64	10·35	14·83	7·32	14·62	4·81	9·62	85·29
1866	2·21	3·91	1·44	1·09	1·45	6·59	7·83	12·34	5·87	10·11	8·17	6·82	67·86
1867	1·31	6·36	·83	1·32	2·33	5·30	12·20	15·21	10·45	7·87	·67	2·71	66·56
1868	2·06	·82	3·20	·64	4·17	7·78	11·35	6·73	5·46	4·66	8·31	1·03	56·21
1869	·08	·93	·74	·41	·69	5·52	10·17	8·74	8·86	5·15	6·30	5·87	53·46
1870	2·61	·56	1·46	1·51	4·65	8·81	11·91	9·00	10·63	3·98	5·94	8·29	69·35
1871	6·62	1·40	2·89	·92	3·97	8·84	11·73	12·97	7·87	4·37	10·73	3·27	74·09
1872	1·45	·07	·74	·39	3·14	7·09	5·45	10·82	3·07	4·80	9·89	3·04	49·95
1873	1·78	1·08	1·98	·53	0·00	4·31	5·04	8·37	5·80	10·34	3·48	1·31	44·02
1874	3·47	1·96	3·67	5·16	2·51	12·28	12·28	11·20	9·38	6·42	3·66	4·29	76·20
1875	3·39	·91	·56	·42	2·61	4·15	12·62	7·22	11·95	10·85	3·74	2·48	60·90
1876	3·26	1·03	1·78	1·67	6·65	11·17	12·23	15·18	12·03	7·04	5·95	3·96	81·95
1877	2·14	0·00	7·46	3·38	3·19	8·43	8·35	12·94	6·39	6·68	7·66	5·48	72·10
1878	3·44	·70	...	3·22	4·99	5·78	5·42	8·88	11·15	5·89	8·72	3·05	60·25
Average monthly Rainfall 1862 to 1878	2·52	1·58	1·78	1·75	3·17	7·30	9·62	10·97	8·72	7·19	6·37	5·20	

Average Annual Rainfall for 17 years—1862-78 ... ... 65·36 in.

HY. PRESTOE, *Government Botanist.*

CANADIAN RAIN GAUGES.

To the Editor of the Meteorological Magazine.

SIR,—On page 42 of your Magazine for April, 1879, in the review of "Instructions to Observers in connection with the Meteorological Service of the Dominion of Canada," I notice the following:—"In one respect we cannot agree with Prof. Kingston. His staff of observers seem to have a very miscellaneous collection of rain gauges, and this has apparently induced Prof. Kingston to abandon as undesirable the usual course of supplying measuring jars adapted to the gauges, and instead of so doing to issue jars divided to cubic inches."

With reference to the above, I remark that the gauge in almost universal use at the Canadian stations has a circular mouth with an area of 10 square inches, so that the glass graduated to cubic inches is exactly adapted to the gauges; the gauge is described in articles 232 to 237 of the instructions, and is shown in the photograph No. 12.—Your obedient servant,

G. T. KINGSTON,

Superintendent of Meteorological Service,
Dominion of Canada.

Meteorological Office, Toronto, Canada, May 3rd, 1879.

[We are very glad to learn the fact stated by Prof. Kingston. But we really cannot blame ourselves for having assumed that the very full details and table given on pages 75, 76, and 77, were considered by the author to be necessary for the use of his observers. Those pages are almost useless where the gauges are 3·57 in. in diameter, and as we now learn that such gauges are "in almost universal use at the Canadian stations," we are rather at a loss to know why these pages were written. No other instructions dwell upon the question half so fully. We believe that any one who reads sections 226 to 230 would arrive at the same conclusion as we did. Space forbids our reprinting the three pages referred to, but we quote the last two paragraphs.

"229. The labour of performing the division by such a number as 50·2656, on every occasion of measuring the rain, may be got over in two ways. One of these methods is to graduate the measuring glass so that its divisions, instead of indicating the cubic inches, &c., contained in the glass, represent the *depth* on the surface, to which the contents correspond *when a gauge of those dimensions is employed.* Thus, if the diameter be 8 inches, as a depth of 1 inch of rain will cause an accumulation of 50·2656 cubic inches in the receiver, a tenth of an inch will give 5.02656 cubic inches nearly. Hence, if the glass be properly graduated, the volumes intervening between the lines of graduation which represent tenths of an inch in depth will be 5·02656 cubic inches.

"This method which is employed extensively in England, is subject to the grave inconvenience that the gauge and the glass must be made each one for the other, so that if either gauge or glass be damaged the observation is stopped until the damaged instrument is replaced by another precisely similar. Now, while a glass adapted for a particular gauge is probably not procurable except from the maker who furnished the gauge, a glass divided to cubic inches

can be procured with greater readiness, and it can moreover be used with any gauge whatever."*

"230. It is much better to avoid altogether the use of glasses which are so graduated as to be adapted exclusively for gauges of certain diameters, and to employ those only which are divided to *cubic inches*, and which can be used with gauges of any area whatever. Where the area of the gauge is expressed by a number which is not a convenient divisor, the labour of performing the division may be avoided by constructing a table giving the quotients which would be obtained by dividing the cubic inches of rain received in the gauge by the area of its mouth expressed in square inches."

* In the event of an injury occurring to the gauge, there is no need to stop the observations while it is under repair, or until it has been replaced by another. Provided that the observer possesses a glass divided into cubic inches, he may employ, as a temporary substitute for his gauge, a common funnel, round which a band of tinned sheet iron is soldered, extending 3 inches above and 3 inches below the edge of the funnel. The funnel should be rested on a common tin pot, of such a size as will allow the lower part of the band above named to overlap it on the outside. The diameter of the mouth of this temporary gauge can be taken as half the sum of two measurements, at right angles to each other, and the area can then be calculated therefrom. Thus, if two measured diameters are 4·24 and 4·28, the area $= \frac{1}{4}(4{\cdot}26)^2 \times 3{\cdot}1416$ nearly $= 14{\cdot}2534$ nearly.
—ED.]

THIRTY WINTERS.

To the Editor of the Meteorological Magazine.

SIR,—I find I made a most unaccountable mistake in my table of 30 winters. I put April, 1861, as being 39°, whereas it should have been 43°. Consequently, *April* as well as *January* was the coldest for 30 years, and there was only one winter within two degrees of the last six months.—Yours truly,

W. LUCAS.

The Firs, Hitchen, 20th May, 1879.

[Three other corrections are rendered necessary by this mistake; the mean for April should be 45°·5, the average for the winter 1860–61, should be 37°·6, and the mean of all the averages 39°·2 instead of 39°·1. The last remark in Mr. Lucas's letter though correct as a broad statement, is not rigorously accurate. In 1853–4 the excess was 1°·9; in 1854–5, 1°·6; in 1859–60, 1°·8; and in 1874–5, 1°·7. All other winters were more than 2° warmer.—ED.]

EXCESSIVE RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—It may probably not be uninteresting to you to be informed of the great rainfall here since the 23rd ult.—total 5·79 inches—as follows:—

	in.		in.
May 23rd	0·74	June 1st	1·30
,, 25th	0·38	,, 2nd and 3rd	0·75
,, 26th	0·10	,, 5th and 6th	0·55
,, 28th	0·03	,, 7th	0·73
,, 29th	0·43	,, 9th	0·02
,, 31st	0·02	,, 11th	0·74
Total	1·70	Total	4·09

Total Fall in May ... ... 3·13 in.

The largest quantity recorded since I have kept a register in so short a time. Our growing crops on heavy lands are taking much harm.—Yours truly,

S. TABOR.

Fennes, Braintree, 12th June, 1879.

REVIEWS.

Meteorological Observations, made at the Adelaide Observatory, during the years 1876 *and* 1877 ; *under the direction of* CHARLES TODD, C.M.G., F.R.A.S., published by the authority of the Government of South Australia. Adelaide : 1878, 246 pp.

THIS work contains very full tables and diagrams of the Meteorological Observations for each month of 1876 and 1877, at the Adelaide Observatory, the observations at 9 a.m., 3 p.m., and 9 p.m. each day, being printed *in extenso.* All through the tables for the two years there is a column for the readings of the minimum thermometer on grass, which is almost superfluous as no observations are entered in it. Next to it, however, is a column giving the radiation temperature on wool ; we do not know whether this is because there is no grass, or because the wool is considered to give better results ; there has recently been some discussion in this Magazine and elsewhere, as to the best material for this purpose, the objection to grass being that the least variation in its length has a considerable effect on the exposure of the thermometer.

The diagrams, of which there is one for each month, are in the usual form, and represent pressure, temperature, force and direction of wind, humidity, ozone, cloud, rain, and evaporation.

The tables of rainfall over the whole colony are particularly good, the total number of stations being about 100, many of them new ones ; at all the old stations, the mean of previous years is given for comparison. The value and interest of these tables would be increased by the insertion of a map of the stations, more especially as the latitudes and longitudes are not given. The stations seem to be mostly in the south, the rest of the colony being represented by a chain of about fifteen stations along the line of the telegraph. The largest amount of rainfall recorded at any station during 1877 was 60·11 in. at Palmerston, on the north coast, and the smallest 5·22 in. at Arrowie.

Another good feature of the work is the very thorough description of the instruments used at the Observatory, going as far as to give the names of the makers and numbers of the thermometers.

The estimation of evaporation is a matter of great difficulty, and we know of no satisfactory instrument for the purpose. The one used by Mr. Todd is, as the following description shows, much the same as that employed by Mr. Griffith, at Strathfield Turgiss.

"The atmometer consists of a large box or tank, made of well

seasoned red gum, lined with zinc; the tank is 4 ft. square, and 3 ft. 6 in. deep; it is sunk in the ground to a depth of nearly 3 ft., and is kept filled with water to within 3 or 4 in. of the top.

"The observations are made in the following manner:—a stout brass bar is placed diagonally over one corner of the tank, resting horizontally on two iron plates; at right angles to this bar is a vertical rod moveable by rack and pinion, graduated to one-tenth of an inch, and read off by means of a fixed vernier to one-hundredth of an inch. The rod, which is pointed at its lower end, is carefully set to water level inside a glass tube of two-inch bore, reaching from the bottom of the tank, the lower end of the tube being perforated, by which means a perfectly smooth surface is secured, even in high winds. A rain gauge by the side of the atmometer measures the rainfall received in the tank."

The result obtained from this instrument, showing that the mean yearly amount of evaparation for the six years—1870–75—was 67·309 in., while the mean annual rainfall is only 24·479 in.; proves how little agreement there is between the evaporation from a water surface, and that from the surrounding country.

Ministère de l'Instruction publique. Bureau central Météorologique de France. Instructions Météorologiques. Paris: Gauthier Villars, 1879. 8 vo., 80 pages.

THERE is a certain sense of appropriateness in the fact that the first publication which we receive from the newly-formed French Meteorological Office is a manual of instructions—to which, by the bye, in an excess of bashfulness, M. Mascart has not attached even his signature, although the work itself bears internal evidence of his supervision, and as Director of the Office he is of course responsible for all its publications.

The introduction is so short and to the point that we translate it entirely:—

"A decree of May 14th, 1878, created a Central Meteorological Office for France. This new Service embraces the study of the great movements of the atmosphere, storm warnings both to seaports and for agricultural purposes, the organization of meteorological observatories, and of regional or departmental commissions, the publication of their works, and all investigations into meteorology or climatology.

"By virtue of this decree all meteorological documents received by the Minister of Public Instruction are collated in this central office.

"Many inquiries having been made for information respecting the organization of stations, the selection and mode of using instruments, we believe that we are meeting a general wish by publishing these *Instructions*, in which we have endeavoured to give accurate and practical information respecting the principal instruments used by meteorologists."

The most original part of this pamphlet is the section of the chapter upon General Arrangements, which treats of the choice of a place of observation, and in which occur the following paragraphs :—

"Observations in large towns never represent accurately the true characteristics of the region which one desires to study. The presence of a number of houses artifically kept at a temperature different from that of the external air, leads to anomalies which may be considerable. Thus the temperature recorded at the Paris Observatory give for the annual mean of that city 50°·9, although observations made in the country by M. Renou enable us to affirm that the real temperature of the region in which Paris is situated is a little less that 50°· However, the observatory is in a quarter well situated with regard to prevailing winds, and which was sparsely inhabited when the observations which yield the above value were made. Observations made with extreme care in the Isle Saint Louis by Commander Delcros gave an annual mean 1°·1 higher than that at the observatory. Therefore, the mean temperature of Paris, deduced from accurate observations of relatively well-placed instruments in the heart of the city, would be at least 1°·8 too high.

"If, instead of considering the mean temperatures, we examine individual observations, we shall find much greater differences, reaching to 7° and even much more. Thus, on December 9th, 1871, although the temperature fell to —10°·3 at Montsouris, and to —11°·9 at Aubervilliers, a minimum thermometer freely suspended at a window on the fourth floor in a court yard open to the North, and quite exposed on that side, in Paris, only fell to 6°·8. There was therefore on that occasion a difference of more than 18°, resulting from the influence of the city and the position of the instruments. Differences of several degrees occur almost daily."

M. Mascart is right in coupling the "position of the instrument' with "the influence of the city," but even then 18° remains a previously unheard-of difference, and if the range of temperature in cities is so vastly less than in the open country, it must surely have an important bearing upon public health. More than twenty years ago we had the pleasure of assisting the Metropolitan Association of Medical Officers of Health in compiling weekly tables of London climate. The stations were St. Mary's Hospital, Paddington; Fulham; Camden Town; Whitehall; St. Thomas's Hospital, London Bridge; Hackney; and Greenwich; but the greatest difference in the individual minimum temperatures which we can find by running over the published tables is on March 26th, 1858, 8°·6 against the above 18°.

These Instructions are intended for what we should call second order stations only, and no anemometers are therefore described, but there is one entirely new feature, viz., a series of definitions of wind force specially designed for observers on land. Our readers are doubtless familiar with the definitions given by Admiral Beaufort for use at sea, definitions which the alterations in the build and rig

of ships have rendered nearly obsolete. M. Mascart now gives the following table :—

No.	Designation.	Force of Wind.	Velocity. Metres per second.	Miles per hour.
0	Calm	Smoke rises almost vertically and the leaves of trees are motionless	0 to ½	0 to 1
1	Slight ...	Perceptible to the hands and face, makes a flag flutter and shakes small leaves	½ ,, 4	1 ,, 9
2	Moderate	Blows a flag fully out, shakes the leaves and small branches of trees	4 ,, 7	9 ,, 16
3	Fresh.....	Shakes the large branches of trees	7 ,, 11	16 ,, 25
4	Strong ...	Shakes the largest branches of trees and the trunks of small ones	11 ,, 17	25 ,, 38
5	Violent ...	Shakes considerably all trees, breaks branches, and the trunks of small trees	17 ,, 28	38 ,, 63
6	Tempest..	Blows down chimneys, tears the roofs off houses, and uproots trees.	28*	63*

* and upwards.

Enclosed with the Instructions was an anonymous price list, of which we think a translation will be interesting to our readers :—

Price List of the Principal Instruments used at Meteorological Stations.

	£	s.	d.		£	s.	d.
Standard Fortin barometer in leather case					4	8	0
Slab for the barometer	1	0	0	to	1	4	0
Brass tripod for barometer					1	0	0
Regnault's boiling point thermometer	2	8	0	,,	3	0	0
Iron thermometer stand (including packing case) ...					8	2	0
Negretti's maximum thermometer	0	6	4	,,	0	10	0
Walferdin's (*i.e.*, Phillips's) maximum thermometer ...					0	8	0
Rutherford's minimum thermometer	0	4	10	,,	0	8	0
Ordinary thermometer for hygrometer					0	8	0
Thermomètre fronde...	0	4	10	,,	0	8	0
Brass frame for thermometers					0	2	4
Regnault's hygrometer	3	16	0	,,	5	16	0
Alluard's ,, ...					4	16	0
Dry & wet bulb hygrometer, thermometers divided to 1°	0	16	0	,,	1	4	0
,, ,, ,, ,, 0°·2	0	16	0	,,	2	8	0
Rain-gauge (Scientific Association Pattern)					0	10	0
,, (Babinet's, large size)	1	8	0	,,	1	10	6
,, (Tenfold multiplier, according to size) ...	1	8	0	,,	1	12	0
,, (Hervé-Mangon's totalizing)					3	12	0

N.B.—Where two prices are given they are the limits between which they vary according to size of instrument or delicacy of graduation.

THE WEATHER IN MAY.

On the 1st of the month an anti-cyclone was formed over Scotland, which spreading gradually southward extended over the whole of the United Kingdom by the 3rd, bringing bright very fine weather with light airs. On the night of the 2nd there occurred an exceedingly sharp frost over Central England. During the next two days (4th and 5th) the weather was governed

by the anti-cyclone, and light breezes from W. in the N. and from E. in the S. were reported, with very fine weather. On the night of the 5th, however, a brisk decrease of pressure took place in the N.; a deep depression passed eastward over Scandinavia, while small subsidiary disturbances passed south-eastward over the North Sea. Behind, these N. winds and gales with cold weather, and showers of snow, hail, and sleet were experienced. From the 6th to the 10th pressure remained highest off our western coasts, and N. winds with cold inclement weather prevailed. On the 10th a brisk fall of the barometer began in the W.; the wind there, backed to S.W., and the temperature rose. Rain fell very generally and heavy snow on some days.

During the next week (11th–17th) the weather continued cold and unsettled. On the 11th and 12th light W. to W.N.W. breezes prevailed with moderately mild weather, the sky, though at first cloudy, subsequently clearing a good deal; but on the 13th a large area of low pressure advanced over these islands and gradually became deeper as it travelled slowly in a south-easterly direction. The wind circulated round this disturbance; at first it was light to moderate in force, and on the 14th thunderstorms were experienced in many localities, but afterwards increasing in strength and blowing a gale from N. on our N.E. coast. By the 16th the disturbance was disappearing over the Netherlands, and the barometer rose briskly in the S.E., while a N. breeze blew over the greater part of this Kingdom. In the W., however, a fresh fall had set in, and the wind had shifted to S. over Ireland. This new decrease was caused by the advance of a fresh disturbance, which was shewn over Ireland on the morning of the 17th, and moved south-eastwards to the British Channel in the course of the day. Rain fell on most days of this week.

No change of any importance occurred during the week succeeding. The weather throughout was rather unsettled, but no serious disturbance reached our shores. On the 18th, 19th, 21st, 22nd, and 23rd depressions crossed these islands, and S.W., W., and N.W. breezes prevailed in succession, the fall on the 23rd causing the wind to rise to a gale in the Hebrides.

Exceedingly unsettled weather prevailed during the remainder of the month, numerous depressions having passed over, accompanied by large quantities of cloud and rain. At first these disturbances passed from W. to E., and cool W. breezes, with weather varying from rainy to fair, prevailed, but on the 27th an area of low readings was formed in the S.W., and hovering over the western part of the English Channel, caused N.E. winds over these islands, thunderstorms, and on the nights of the 27th and 28th great falls of rain in some places. On the 29th the depression was apparently filling up and moving westward; and on the 30th S. winds, with fair warm weather, prevailed for a time in the S.E., though rain and N.E. winds continued in the W. and N. On the morning of the 31st a shallow subsidiary depression was shown in the S., with a deeper disturbance over Norway, the weather being showery and unsettled, but by the afternoon the depression was moving away eastwards, and fine weather was experienced.

Temperature during the first three weeks of the month was below the average generally, sometimes much. It was very uniform during the last week, ranging mostly from 50° to 60°. H. E. M.

SWISS FLOODS.

GENEVA, JUNE 1.

"Alternate rain, snow, and sunshine are rendering the Alpine passes very dangerous, causing numerous avalanches, filling the lakes, and making the rivers overflow. On Tuesday, May 27th, the lower part of St. Gall was flooded. The river Steinach rose to a greater height than has been known for 20 years, and traffic on the line from Rohrbach to St. Gall had to be suspended. On the same day two Italian workmen were killed by an avalanche at Bals, in the Grisons."—*The Times.*

SUPPLEMENTARY TABLE OF RAINFALL IN MAY, 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	2·90	XI.	Port Madoc	3·54
,,	Littlehampton	2·99	,,	Douglas	2·13
,,	Horsham, Swallowfield.	...	XII.	Carsphairn	2·18
,,	Hastings, Manor House	3·08	,,	Melrose, Abbey Gate...	1·75
,,	Hailsham	2·69	XIV.	Lanark, Baronald	...
,,	I. of W., St. Lawrence.	1·97	XV.	Islay, Gruinart School..	2·13
,,	Strathfield Turgiss	3·46	XVI.	St. Andrew's, Cambo...	·65
III.	Great Missenden	3·80	,,	Aberfeldy H.R.S.	...
,,	Winslow, Addington ...	2·39	XVII.	Tomintoul	2·54
,,	Oxford, Magdalen Col...	2·77	,,	Keith H.R.S.	4·12
,,	Northampton	2·90	,,	Forres H.R.S.	3·03
,,	Cambridge, Merton Vil.	3·34	XVIII.	Strome Ferry H.R.S....	3·31
IV.	Harlow, Sheering	3·11	,,	Lochbroom	2·30
,,	Diss	2·28	,,	Auchnasheen H.R.S. ...	2·74
,,	Swaffham	3·30	,,	Tain, Springfield	2·60
,,	Hindringham	2·78	,,	Loch Shiel, Glenfinnan.	5·20
V.	Salisbury, Alderbury...	2·42	,,	Dalwhinnie H.R.S.....	...
,,	Calne, Compton Bassett	3·53	XIX.	Lairg H.R.S.	...
,,	Beaminster Vicarage ...	2·95	,,	Altnabreac H.R.S.	1·40
,,	Dartmoor Prison	4·73	,,	Watten H.R.S.	1·86
,,	Langtree Wick	3·34	XX.	Fermoy, Glenville	2·78
,,	Lynmouth, Glenthorne.	2·73	,,	Tralee, Godfrey Place...	2·94
,,	St. Austell, Cosgarne...	2·15	,,	Cahir, Tubrid	1·61
,,	Taunton	3·23	,,	Tipperary, Henry St....	2·01
VI.	Bristol, Ashleydown ...	3·33	,,	Newcastle West	2·04
,,	Wem, Sansaw Hall.....	1·88	,,	Kilrush	2·22
,,	Cheadle, The Heath Ho.	2·49	,,	Corofin	2·38
,,	Bickenhill Vicarage ...	2·82	XXI.	Kilkenny, Butler House	1·76
VII.	Melton Mowbray	3·90	,,	Ballymore, Eustace ...	...
,,	Horncastle, Bucknall ...	4·00	,,	Kilsallaghan	2·52
VIII.	Walton-on-the-Hill.....	2·18	,,	Navan, Balrath	2·18
,,	Broughton-in-Furness ..	2·42	,,	Athlone, Twyford	2·87
IX.	Wakefield, Stanley Vic.	1·78	,,	Mullingar, Belvedere ...	3·05
,,	Ripon, Mickley	1·56	XXII.	Ballinasloe	1·76
X.	Gainford	1·35	,,	Clifden, Kylemore	4·01
,,	Haltwhistle, Unthank..	2·28	,,	Crossmolina, Enniscoe..	2·78
,,	Shap, Copy Hill	·97	,,	Carrick-on-Shannon ...	3·14
XI.	Llanfrechfa Grange	3·56	,,	Dowra	2·85
,,	Llandovery	3·39	XXIII.	Rockcorry	2·87
,,	Solva	2·74	,,	Warrenpoint	4·40
,,	Castle Malgwyn	3·09	,,	Newtownards	3·80
,,	Rhayader, Nantgwillt..	3·48	,,	Larne, Carnlough	3·12
,,	Carno, Tybritle	2·07	,,	Bushmills	3·49
,,	Corwen, Rhug	2·73	,,	Buncrana, Rockfort ...	3·08

MAY, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	3·46	+ 1·06	1·30	28	19	6·90	20	30·6	10	2	8
II.		Maidstone (Hunton Court)	2·95	+ ·71	1·40	28	16	...	...	...	...	...	...
,,		Selborne (The Wakes)	...	...	...	...	...	...	...	...	...	...	...
III.		Hitchen	2·77	+ ·84	·70	28	18	63·0	21†	26·0	9	7	...
,,		Banbury	2·91	+ ·69	·68	28	21	66·5	21	25·0	10	8	...
IV.		Bury St. Edmunds (Culford)	2·86	+ ·70	·51	15	20	72·0	20‡	24·0	9	6	9
,,		Norwich (Sprowston)	...	...	...	...	...	...	...	...	...	...	...
V.		Bridport	2·40	+ ·37	·79	27	15	...	...	...	...	...	...
,,		Barnstaple	2·49	+ ·05	·53	27	19	...	...	...	...	...	...
,,		Bodmin	2·05	— ·41	·56	17	21	66·0	12	34·0	2	0	6
VI.		Cirencester	2·72	+ ·44	·82	28	16	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	2·55	+ ·29	·59	28	19	67·0	21	26·5	3	5	8
,,		Tenbury (Orleton)	2·88	·00	·84	14	21	68·5	21	25·7	3	6	8
VII.		Leicester (Town Museum)	3·22	...	·79	14	22	67·3	21	26·8	10	3	16
,,		Boston	3·32	+ 1·38	...	...	20	70·0	5	28·0	3	4	...
,,		Grimsby (Killingholme)	3·11	...	1·00	14	17	63·0	31	30·0	10	1	...
,,		Mansfield	3·64	...	·76	15	17	66·4	5	25·8	10	3	8
VIII.		Manchester (Ardwick)	1·73	— ·65	·35	30	18	66·0	17	33·0	2,10	...	...
IX.		York	2·09	+ ·14	·36	29	18	69·0	6	27·0	10	4	8
,,		Skipton (Arncliffe)	2·08	— 1·27	·47	25	17	...	...	...	...	...	...
X.		North Shields	2·28	— ·36	·37	22	21	62·4	5	31·0	10	2	3
,,		Borrowdale (Seathwaite)	4·67	— 4·87	·93	24	15	...	...	...	...	...	...
XI.	WALES.	Cardiff (Crockherbtown)	2·86	...	·88	28	15	66·0	21	31·4	3	2	...
,,		Haverfordwest	3·60	+ ·88	·74	28	18	64·5	20	28·5	2	4	8
,,		Aberdovey	...	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	1·88	— ·50	·27	31	12	59·8	3	32·6	2	...	...
XII.	SCOTLAND.	Cargen	1·57	— 1·37	·42	24	13	66·0	29	27·8	2	4	...
,,		Hawick (Silverbut Hall)	2·05	...	·29	22*	14	...	...	..	...	...	...
XIV.		Annanhill	...	...	...	...	...	...	...	...	...	...	...
XVI.		Kilmory	2·72	...	·91	14	14	...	...	28·0	2,3,4	8	...
,,		Mull (Quinish)	3·02	...	·53	16	13	...	...	...	...	...	..
,,		Loch Leven	1·90	— ·30	·50	31	10	...	...	...	...	...	...
,,		Tyndrum (Ewick)	...	...	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	2·44	+ ·46	·71	30	12	62·0	12	32·0	2	1	...
,,		Braemar	2·12	+ ·32	·53	29	15	60·1	4	25·0	2	11	20
XVIII		Aberdeen	2·93	...	·54	29	21	63·2	5	32·1	2	0	10
,,		Portree	2·94	— 2·71	·56	10	23	...	...	...	...	...	...
,,		Inverness (Culloden)	2·68	+ 1·12	·84	30	10	61·2	3	29·0	1	1	14
XIX.		Dunrobin	2·63	+ 1·18	·79	12	20	61·5	3	31·0	1	3	...
,,		Sandwick	2·50	+ ·24	·60	26	20	55·2	24	30·7	9	2	6
XX.	IRELAND.	Cork	1·45	...	·52	17	10	...	...	...	...	...	...
,,		Caherciveen Darrynane Abbey	2·64	...	·60	16	16	...	...	...	...	...	...
,,		Waterford	1·77	— ·48	·37	17	18	63·0	5,20	30·5	3	2	...
,,		Killaloe	3·03	— ·15	·98	16	14	74·0	31	26·0	3	3	...
XXI.		Portarlington	2·03	— 1·17	·50	16	21	63·0	...	31·0	1	3	...
,,		Monkstown, Dublin	...	...	...	...	...	...	...	...	...	...	...
XXII.		Galway	1·89	...	·38	16	15	60·0	16	32·0	2	1	...
XXIII		Waringstown	3·96	...	·93	16	20	61·0	2	27·0	2	7	11
,,		Edenfel (Omagh)	3·35	...	1·00	16	18	62·0	21‖	27·0	1	5	...
,,		Ballyshannon	...	...	...	...	...	...	...	...	...	...	...

* And 15. † And 24. ‡ And 30. ‖ And 29.

+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON MAY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

HITCHEN.—A tremendous TS occurred in the valley of the Lee on the 28th, causing floods almost equal to those of June 30th, 1878.

BANBURY.—S and H on the 1st and 5th; high wind on the 15th; T on 22nd; TS on 28th.

CULFORD.—Mean temp. of the month, 49°·5; N. or E. winds prevailed on thirteen days. A very severe TS occurred on the night of the 28th, accompanied by ·25 in. of R; S on the 6th and 7th; H on 6th, 7th, and 9th; high wind on 14th.

BODMIN.—Mean temp. of the month 53°·8, 1°·9 below the average.

CIRENCESTER.—A cold, and rather sunless, month.

SHIFNAL.—The month opened with cold E. wind and sleet, followed by frost at night, which was repeated with one exception till the 12th; R almost daily from the 8th till the close, ·59 in. falling on the 28th; pitch dark at noon on 14th, with distant T in S.E., followed by violent R; it was also extremely dark at 5 p.m. on 19th. Winds, with few exceptions, from N.N.W. and N.E. Vegetation still about three weeks backward. Violent N.W. gale on 15th. Asparagus first cut on 4th. Young rooks out on 6th; wild cherry and damson blossoms, 16th; turtle doves and swifts arrived on 17th; martins arrived on apple in blossom on 26th; oaks only in tender yellow leaf by 29th.

ORLETON.—Many fine and pleasant, but cold, days occurred at the beginning of the month, with frequent frosts at night. On the 14th a TS set in at 10 a.m. with heavy R, followed by great darkness at 2.15 p.m. The remainder of the month was variable, but generally cold, with frequent falls of R. Mean temp. of the month nearly 4° below the average, making the seventh month in succession with a temp. below the average. Cherry trees came into full bloom about the 3rd, damsons about the 7th, pear trees about the 23rd, and apple trees about the 27th.

LEICESTER.—H on the 1st, S on the 7th and 8th, TS 11 a.m. to noon on 14th.

BOSTON.—A cold, dull, wet month, with several sharp frosts, the ther. at 4 ft. falling to 28° on the 10th. All vegetation very backward; cowslips were not in flower till the 11th, and lilac not till the 28th; hawthorn and laburnum not in flower by June 3rd; the elms began to break into leaf about the end of the first week.

GRIMSBY.—Several times during the month winter for a short time feigned to retreat, notably on the 31st, but for the last hours of the month he was again in possession. The wettest May but one in the last fourteen years. The scarcity of small birds, both resident and migrant, shows what havoc the protracted cold period has produced amongst them. T on 10th, 13th, and 31st.

MANSFIELD.—Sharp frosts on 3rd and 4th, S on 7th, T on 14th, TS at 1.30 p.m. on 26th.

MANCHESTER.—The month was very ungenial, not at all like a spring month, the weather being gloomy and cold, especially in the early part, when there were frosts on several occasions. Vegetation is, in consequence, a month later than usual. Slight S on 7th.

YORK.—S on three days.

ARNCLIFFE.—S on 6th, 7th, and 9th.

NORTH SHIELDS.—H on 1st, 6th, 7th, and 8th; S on 6th, 7th, 8th, and 9th.

SEATHWAITE.—Beginning of month cold; warmer towards the end.

WALES.

HAVERFORDWEST.—The first seven days of May were very cold, and the nights frosty air, very dry and keen easterly wind. S fell heavily on the 7th; the weather from that date to the end of the month was cold, with R at night,

excepting a few warm days from the 18th to the 21st. The 28th commenced with R, about 4 p.m. the sky became densely overcast in the E., and distant T was heard; the storm approached nearer till 5 p.m., when it was very violent, the flashes of forked lightning following each other in rapid succession.

LLANDUDNO.—Though the month was characterized by a large amount of sunshine, and was free from frost, the mean temp. was about 3°·5 below the average, no doubt owing to the great prevalence of polar winds. The R fell mostly in the latter part of the month, and was just in time to ensure a good hay crop. Fruit is well set and promises to be an abundant crop; potatoes also promise well.

SCOTLAND.

CARGEN.—Mean temp. of the month 2° below the average. Vegetation very backward.

HAWICK.—The month has been cold and vegetation of all kinds is fully three weeks late. The winds have been mostly easterly, but very changeable. Keen frosts on the mornings of the 1st and 2nd; hills white with S on the 6th, 7th, and 8th; T and H on the 25th; swallows appeared on the 5th, but disappeared again for a fortnight, owing, no doubt, to the scarcity of insect food.

KILMORY.—The temp. of the month was particularly low, especially during the night, and vegetation has been much retarded. The oak, ash, and sweet chestnut are this year coming into leaf almost simultaneously. A remarkable profusion of blossom on apples, pears, and currants, also on the beech and elm; the latter present a very unhealthy appearance, in many instances pushing out hardly any leaves, and what there are not at the points of the branches, but on the sides in small bunches, giving the idea of the flow of sap being checked, very similar to the effect of the larch disease. I have observed a tree here or there thus affected in previous years, particularly in wet ground, but it seems now to be irrespective of situation and to an extent that calls for enquiry as to the cause. I shall be glad to know if other observers have noticed the disease.

QUINISH.—Month, on the whole, cold and backward until the 27th; persistent N. wind until the 16th; from 16th to end, warm and wet from S.W. and cold drought from N. alternately, the changes from one to the other being curiously sudden and frequent.

ABERDEEN.—Mean temp. 46°·5, 1°·8 below the average for 22 years; rainfall 1·08 in. above the mean of 22 years. A month of cold, wet, ungenial weather. Crops unusually backward; S on 3 days; H on 5; and fog on 5.

PORTREE.—A very cold, frosty month, scarcely any vegetation. Grass on pastures quite brown. More frost and S than have ever been known before in May. A third of the young lambs have succumbed to the cold.

CULLODEN.—Temp. low; easterly winds prevailed. Willow wren, swallows, cuckoo, and landrail all late in arriving. Vegetation advancing by the close of the month.

SANDWICK.—The weather in May has been a great improvement on that of the preceding months. The first five days were favourable to vegetation, the next five we had S or H showers, then more favourable weather, when vegetation made great progress; but towards the latter part we have had prevailing cold N. and E. winds. The sea was uncommonly high on the 21st and three or four following days, without any high wind here to cause it. It was probably the storm predicted from America which raised the Atlantic, though the storm did not reach us.

IRELAND.

DARRYNANE ABBEY.—A harsh, cold month, with northerly winds almost constantly. Vegetation very backward.

WATERFORD.—Wind throughout the month slight at 9 p.m., usually northerly, but at 9 a.m. variable, or calm.

KILLALOE.—A cold, backward month, with almost continuous N. wind.

OMAGH.—Weather still harsh and inclement; vegetation very backward.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLXII.] JULY, 1879. [PRICE FOURPENCE. or 5s. per ann. post free.

SIGNAL OFFICE PUBLICATIONS.

We have already described two of the publications of the Washington Office—viz., "Daily U.S. Weather Maps" and "Daily Bulletin of International Meteorological Observations;" there remain many other forms in which the energy and power of the office is displayed, some of which we proceed to notice.

Monthly Weather Review.—We take as a specimen the latest number—that for May of the present year. Even the title tells a tale; it is as follows:—"Monthly Weather Review, May, 1879 (General Weather Service of the United States), War Department, Office of the Chief Signal Officer, Division of Telegrams and Reports for the Benefit of Commerce and Agriculture." The absence of any technical word, even so popular a one as "meteorology" is noticeable; the title all through implies business; we have "weather," not "meteorology;" we have no reference to scientific bodies; we are told that the object is to benefit commerce and agriculture, and evidently the office aims straight at that object. The Review is a quarto pamphlet of sixteen pages, with five beautifully-executed maps. The contents are as follows:—Introduction (details of the data employed); Barometric Pressure; Areas of High Barometers (not called anti-cyclones); Areas of Low Barometers (not called cyclones); International Meteorology (surely rather *too* International, for in little more than one page we have observations on various dates between December 7th, 1878, and April 13th, 1879, and scattered over the North Atlantic, South Atlantic, North Pacific, South Pacific, and Indian Ocean. We fear that no one will learn much from an undigested medley of this sort, and we do not know in what way it will benefit either commerce or agriculture); Unalaska Island, Alaska; York Factory, Hudson's Bay; Paramaribo, Dutch Guiana. (These three localities are represented by abstracts of the results of observations during parts of 1878 and 1879. As regards the first, there seems to be a misprint as well as a practice of questionable expediency. We are told that the mean temperature is obtained by

"$\frac{1}{4}$ (7 + 2 + 4 + 9 + 9);" we assume that $\frac{1}{4}$ should be $\frac{1}{5}$, and that the hours of observation are 7 a.m., 9 a.m., 2 p.m., 4 p.m., and 9 p.m., but if so, what an unusual combination; we can understand 12-hour intervals, 9 and 9; 7-hour intervals, 7, 2, and 9; a combination of the two systems, 7, 9, 2, 9, or the same with a 6-hour interval, *i.e.*, 9, 3, and 9, added to 7, 2, and 9, giving 7, 9, 2, 3, and 9; but what use the 4 p.m. readings can be we cannot guess. There is much valuable information in these three extracts, but surely it would have been better to keep them in the office until at least data for a twelvemonth had accumulated, and then to give them in regular form; the facts are very valuable, but unless the Signal Office intends to publish a very full index to its Review, fragments like these, in spite of their value, must of necessity be forgotten). Temperature of the Air, minimum and maximum temperatures are given for many stations; Ranges of Temperature; Frost injurious to Vegetation; Ground Frozen; Ice. A page and a half is devoted to Precipitation, with the following sub-headings:—Special Heavy Rains (the most noteworthy was 2·00 in. in 52 minutes at Woodstock, Maryland, on May 19th); Largest Monthly Falls (the largest 8·65 in. at Concord, Iowa); Smallest Monthly Rainfalls (in South-Eastern California, Arizona, and Western New Mexico no rain is reported); Rainy Days; Cloudy Days; Hail (several heavy storms are mentioned, *e.g.*, at Graham, Texas, on the 30th, stones weighed an ounce; at Eagle Pass, Texas, on the 5th, they were 3 in. in circumference; 30 miles south of Corsicana, Texas, on 25th, a hail storm, whose track was $1\frac{1}{2}$ miles wide and 8 miles long, did great damage to wheat, corn, and cotton crops; and at Greenwood, Wisconsin, on the 3rd, stones were found $2\frac{1}{2}$ in. by $3\frac{1}{4}$ in). Snow, depth of snow on ground at end of month; Droughts (complaints of droughts were general from all parts of the States. We quote three reports:—Campo, California: "Driest and coldest May for 20 years, springs drying up;" Missouri: "Eastern part of the State suffering greatly from lack of rain, small grain and fruit much injured;" and, lastly, Prof. Kingston reports that "the months of April and May were, in the vicinity of Lake Ontario, the driest on record)." Floods (none reported); Relative Humidity; Winds; Total Movements of the Air; Local Storms. (We reprint the whole of this section in confirmation of the paragraph, which we gave in our last, extracted from *The Times* telegram:—

Local Storms.—May 29th, warm, moist southerly winds, with fair weather, prevailed over Iowa and southward to the Gulf States. About 5 p.m. a hail storm of great violence passed from the S.W. to the N.E., through Holt County, New Mexico, and then, developing into a tornado, passed eastward through the southern part of Nodaway Co., New Mexico, for about 16 miles, having a width of 300 to 3000 feet. It began near Smith passed south of Barnard and north of Bockolow [Bolockow?] and was last seen moving towards Conception, but apparently rose and was dissipated before reaching that place. The north side of the track was straight, clear and well-defined; the south side was jagged,

looped and curved. On the same afternoon heavy hail and rain-storms occurred in Lawrence Co. and Riley Co., and many other portions of Kansas.

May 30th, lower temperatures prevailed in Missouri and Kansas and the advancing edge of the area of cold N.W. winds passing eastward over western Nebraska and Kansas, was accompanied by severe local thunder and hail-storms, and in some places by tornadoes. At 4.35 p.m., Washington time (or 3.15 p.m., local time on the 97th meridian) an oval area extended for 300 miles from the west of Fort Sill to the south of Omaha, and having a shorter diameter of about 50 miles; towards this the winds were blowing from all directions, being warm, brisk S.W. on the east side, and cold, high N.W. on the west side. At 11 p.m. this area is represented by a smaller one of low pressure in southeastern Nebraska and two of converging winds respectively in S.E. Iowa and central Missouri. Severe tornadoes or equivalent local storms occurred between 3 p.m. and 11 p.m. as follows :—

1, Scardia, Republic County, Kansas.

2, at 4 p.m., tornado passed 4 miles north-west of Minneapolis, Ottawa Co., Kansas, path 10 to 15 miles long, 1000 feet wide; very violent at Delphos, Ottawa Co.; in all 18 persons reported killed.

3, between 6 and 6.30 p.m. tornado passed from Candreys house near county line between Riley and Clay Counties, Kansas, northeastward over or near Stockdale and Randolph, in Riley County; path [30?] miles long; very destructive; 3 persons killed.

4, From 7.45 to 8 p.m. tornado passed eastward over Blue Rapids, Irving and Frankfort, Marshall Co., Kansas, and Centralia, Nehema, Co., Kansas; very severe at Irving; high winds prevailed to long distances from central path, which was about 30 miles long; in all over 30 persons killed and over 50 severely injured.

5, Richardson Co., Nebraska, the preceding tornado reported to have reappeared in this county.

6, At 1 p.m. [10? p.m.] near Kirksville, Adair Co., New Mexico; 1 person killed.

7, Between 7 and 9 p.m., at Craig, Holt Co., New Mexico; this storm was seen by observer at Corning, Holt County.

8, About 6 p.m. tornado seen to form about 2 miles north of Lee's Summit, Jackson Co., New Mexico; passed near Blue Springs and Oak Grove, and was seen to dissipate near Judge Williams' House; passed northeastward, 10 miles long and 100 feet wide; 5 or 6 killed. This same storm was seen by observers at Independence and Buckner, New Mexico.

9, In Wayne Co., and at 9.10 a.m,, local time, in Appanoose Co., Iowa, at a point 15 miles N.E. of Unionville, Putnam Co., New Mexico; 1 killed; (probably a heavy thunder and hail storm rather than a well developed tornado).

Verifications; Indications (Anglicè forecasts); Cautionary Signals; Navigation; Stage of Water in Rivers; Ice on Lakes and Rivers; High Tides; Temperature of Water; Atmospheric Electricity; Thunderstorms; Auroras; Telegraphic Communication interfered with by Atmospheric Electricity; Optical Phenomena; Solar Halos;

Lunar Halos; Miscellaneous Phenomena; Botanical; Birds; Fish; Miscellaneous; Meteors (Prof. G. Hinrichs, of Iowa, reports a "brilliant meteor in the northwest at 5 p.m. of the 10th; detonations of extreme violence marked the end of its path over Dickinson and Emmet Counties, which were heard over 100 miles in every direction. Two large *meteorites*, of the class *syssideres* have thus far been found, weighing 460 and 150 lbs. respectively"); Polar Bands; Prairie and Forest Fires; Mirage; Zodiacal Light; Earthquakes; Sunsets (The characteristics of the sky at sunset, as indicative of fair or foul weather, for the succeeding twenty-four hours, have been observed at all Signal Corps stations. Reports from 131 stations show 4,034 observations to have been made, of which 53 were reported doubtful; of the remainder, 3,354 or 84·2 per cent. were followed by the expected weather); Sun Spots; Notes and Extracts (of these there are three, one refers to an irregular barometric curve, another to a cyclone which occurred in Switzerland, and the third to the Verglas mentioned on page 53 of this Magazine. This note we append :—

[*Note of Mr. E. Nouel, from Comptes Rendus.*]

In a note on the theory of hoar frost and *verglas*, (frozen rain,) printed in Vol. XI. (1863,) of the *Annuaire de la Société Météorologique de France*, page 26, I showed that the great verglas are not due, as is believed, to a rain *above zero* [centigrade], partly freezing by contact with objects whose temperature is below zero, but that they arise from a rain several degrees *below zero* [C.], in liquid state, falling through air *below zero* [C.], and congeal upon the surface of objects, in a continuous manner, through the effect of the surrounding temperature.

This theory has been twice strikingly confirmed this winter, at Vendome. 1st, During the night of January 7th and 8th, a storm accompanied by a rain of 23·5 millimetres (0·92 inch) of frozen water, and by a temperature varying between 0° and —1° centigrade, (32° and 30°·2 Fahrenheit,) caused a *verglas* of about 15 millimetres, (0·59 inch) in thickness, which greatly damaged the trees. 2nd, The 22nd and 23rd of January following, a rain which lasted 30 hours, scattered over a period of 40 hours, produced a coating of transparent ice which I estimated at 25 millimetres (0·99 inch), and the temperature of the air was on an average of —2° centigrade (28°·4 Fahrenheit) during all this time.

Several observers have addressed to the Academy (sessions of day January 27th and February 3rd) notes on the great *verglas* of January 22nd and 23rd, Messrs. Nasse and Godefroy have joined thereto, (*Comptes Rendus* p. 192 and 244), a theory as to its formation. This theory is only a reproduction of that which I had conceived on occasion of a like phenomena, December 25th, 1860, and which I published in the *Annuaire de la Société Météorologique* in 1863. It appears that it has remained unknown to physicists, whose attention has been awakened only this year by the exaggeration itself of the phenomena which has assumed proportions unheard of until now.

We have yet to notice the five maps which accompany this Review. No. 1, 2 and 3 are maps of North America, on the scale of about 330

miles to an inch. No. 1 is virtually a key to the tri-daily maps issued by the Department; each of the latter of course shows one or more localities where the barometric pressure is low. In this map these depression centres are joined so that one can follow them in their path across the States. No. 2 gives Isobars, Isotherms, and prevailing winds for the month. No. 3 is a tinted rain map with five gradations of 2 in. each — plain white indicating a monthly total under 2 in., and the deepest tint a total of 8 in. or upwards. It is a capital map, and nothing but the cost prevents our giving a similar one with each number of this magazine. There are also two international charts on the very small scale of which we issued a specimen with our May number—a scale of about a thousand miles to an inch. One gives Isobars, Isotherms, and prevailing winds; the arrows indicating the winds are so systematically arranged as to make one wonder very much upon what observations they can be based. The last map, representing ocean storm tracks, is similar to No. 1, but is on the smaller scale, so as to include both America and Europe, and represents four storms crossing the Atlantic in periods ranging between $3\frac{1}{2}$ and 6 days.

SOUTH AUSTRALIAN DROUGHT.

(Adelaide, May 17th, 1879).

The lengthened drought, which has caused so much anxiety and distress, has broken up, and very general rain in all the agricultural districts has been registered. The drought was so protracted, and the supply of water in the reservoirs near Adelaide was so reduced, that the residents in the city and suburbs had to be placed on short commons. The use of water for irrigating purposes and hydraulic lifts was forbidden; and had the dry weather continued much longer, a still further curtailment would need to have been made. Happily, however, the danger of something like a water famine has passed away. The rains have quite changed the aspect of affairs. So far the season has been favourable, and the young corn, which is springing up, seems vigorous and healthy.—*The Colonies.*

MEXICAN METEOROLOGY.

WE have been favoured with several publications lately from Mexico, and for the present notice have selected two. One is an octavo pamphlet*, the other is a yearly summary, so good and compact that we have translated it, converted the figures into English measures, and reprinted it at the end of this notice.

* La Ley de Periodicidad de las Lluvias en el Valle de México, por V. Reyes. Mexico, F. Diaz de Leon, 1879.

The pamphlet is a paper read at the February meeting of the Mexican Geographical Society. The most valuable part of the paper is a table which, converted into English measures, is as follows :—

Rainfall at San Nicólas Buenavista, Xochimilco, Mexico.

Year.	Depth. in.	Diff. from Mean. in.	Year.	Depth. in.	Diff. from Mean. in.
1855	30·18	+ 6·41	1867	29·33	+ 5·56
6	23·05	— ·72	8	19·86	— 3·91
7	19·59	— 4·18	9	17·33	— 6·44
8	19·88	— 3·89	1870	20·43	— 3·34
9	25·11	+ 1·34	1	27·17	+ 3·40
1860	13·98	— 9·79	2	21·42	— 2·35
1	29·44	+ 5·67	3	22·27	— 1·50
2	25·16	+ 1·39	4	26·57	+ 2·80
3	21·77	— 2·00	5	20·39	— 3·38
4	28·91	+ 5·14			
5	36·38	+ 12·61	Mean	23·77	
6	20·95	— 2·82			

Señor Reyes goes on to remark that in order to render the fluctuations in these amounts easily followed, he has laid them down on a diagram, and that inspection of it demonstrates—

"1° That from 1855 to 1871 the maxima are reproduced alternately, each four and each two years in the following order :— 1855-59-61-65-67-71.

"2° That from 1857 to 1872 the minima occur each three years thus—1857-60-63-66-69-72."

Señor Reyes has fallen into the error which so frequently attends those who are looking for cycles—that of extracting only the data which are favourable to his theory. We have sorted the years into those of excess and deficiency, and have prefixed an asterisk to those quoted by Señor Reyes :—

Rainfall above average.	in.	*Rainfall below average.*	in.
* 1855	+ 6·41	1856	— ·72
* 1859	+ 1·34	* 1857	—4·18
* 1861	+ 5·67	1858	—3·89
1862	+ 1·39	* 1860	—9·79
1864	+ 5·14	* 1863	—2·00
* 1865	+12·61	* 1866	—2·82
* 1867	+ 5·56	1868	—3·91
* 1871	+ 3·40	* 1869	—6·44
1874	+ 2·80	1870	—3·34
		* 1872	—2·35
		1873	—1·50
		1875	—3·38

Hence it is clear that there is much support for his second rule, but the first breaks down in 1873, which ought to have been wet and was not. We do not understand why he did not include 1875 in the instances of fulfilment of his second rule, which certainly has remarkably strong support.

Central Meteorological Observatory of Mexico.

Lat. 19° 26′ N.; Long. 6h. 36m. 27s. W. of Greenwich; Altitude 7,431 feet.

General Summary for the Year 1878, *drawn up by* V. REYES, *Civil Engineer.*

Meteorological Elements.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Synopsis.
Barometer—Reduced to 32°	23·085	23·055	23·067	23·024	23·096	23·100	23·098	23·095	23·122	23·118	23·115	23·111	Annual Mean, 23·090 in.
,, Absolute max.	23·226	23·241	23·232	23·161	23·219	23·219	23·213	23·204	23·213	23·284	23·254	23·232	Extreme Max., 23·284 ,,
,, ,, min.	22·958	22·907	22·866	22·884	22·997	22·938	22·953	22·914	23·001	23·008	22·924	22·926	,, Min., 22·866 ,,
Temperature. Mean	55·2	57·4	61·2	67·8	67·5	66·0	64·0	62·1	61·5	59·7	57·6	54·1	Annual Mean, 61·°2 F.
Max. in shade	77·0	77·5	83·8	88·9	85·1	84·2	82·4	81·0	76·1	75·2	73·6	71·6	Extreme Max., 88°·9 F.
Min. in shade	35·1	37·4	41·9	43·7	52·2	51·8	53·1	52·5	47·8	41·7	41·4	30·2	,, Min., 30°·2 F.
Max. in sun	100·0	99·9	107·1	111·9	111·6	117·5	109·0	114·1	120·6	117·0	109·0	116·1	,, Max., 120°·6 F.
Radiation minimum	24·1	28·4	32·0	34·9	38·5	43·9	47·1	45·3	41·0	30·0	34·9	19·0	,, Min., 19°·0 F.
Daily range of shade max.	34·0	36·4	38·2	37·4	29·0	29·7	27·5	25·6	23·8	28·1	26·1	33·1	,, Max., 38°·2 F.
,, ,, ,, sun ,,	69·8	68·6	66·4	66·4	71·5	69·5	60·3	65·9	74·2	76·0	71·1	91·3	,, Max., 91°·3 F.
Soil at 2 ft. 9 in. deep	57·6	56·3	57·6	59·4	62·4	63·9	63·9	63·5	63·0	62·1	60·3	58·3	Annual Mean, 60°·6 F.
Humidity	53	40	42	33	49	60	72	78	72	70	63	53	,, ,, 57.
Tension of vapour	·240	·191	·230	·220	·333	·389	·443	·452	·414	·372	·309	·237	,, ,, ·319 in.
Vapour in 1 cubic metre	95	75	90	85	129	151	172	177	161	146	122	94	,, ,, 125 grains.
Mean daily evaporation in sun	·22	·33	·34	·46	·37	·31	·24	·21	·23	·22	·21	·26	,, ,, ·28 inch.
Days of rain	2	2	4	2	15	16	27	24	15	9	1	2	Total, 119.
Rainfall—Monthly total	·20	·02	·08	·00	3·11	2·78	7·76	13·60	5·38	2·16	·01	·02	,, 35·13 inches.
,, Greatest daily fall	·20	·02	·05	·00	·95	·60	2·44	2·11	1·54	1·60	·01	·02	Greatest Daily Fall, 2·44 in.
Mean amount of cloud	2·6	2·0	3·2	1·5	4·6	5·7	7·3	8·2	6·6	5·3	3·9	2·2	Annual Mean, 4·4.
Prevailing direction	S.W.	S.W.	S.W.	S.W.	S.W.	N.E.	N.E.	E.	N.E.	N.E.	S.W.	S.W.	Mean Annual Direction,
Number of cloudy days	3	4	6	1	12	19	23	27	19	14	5	0	Total, 133. [N. ¼ N.E.
,, ,, cloudless*,,	18	22	21	23	11	7	0	0	3	9	16	22	,, 152.
Wind—General direction	E.	S.W.	S.E.	S.W.	N.W.	N.W.	N.W.	N.W.	N.W.	N.W.	N.W.	S.E.	Prevailing Direction, N.W.
,, Mean hourly velocity.	2·0	3·8	2·5	3·4	2·5	3·6	2·5	2·2	2·4	2·5	1·1	·9	Annual Mean, 2·5 miles.
,, Maximum ,,	22	24	20	22	34	36	22	40	23	23	21	21	Extreme Max., 40 miles.
Mean amount of ozone	2·2	3·1	3·7	4·1	4·6	4·9	3·3	3·0	3·4	3·2	2·9	2·9	Annual Mean, 3·4.
Days with thunderstorms	1	0	0	0	15	19	26	18	20	14	2	3	Total, 118.

* Possibly this element is incorrectly described; we do not know the precise meaning of the word "despejados."—ED.

REVIEWS.

Barbados Agricultural Gazette and Planters' Journal. Vol. I. Bridgetown; 4to.

THIS journal, published by the Barbados Agricultural Society, is to a certain extent a continuation of the *Agricultural Reporter*, the issue of which was stopped by the destruction by fire, of the offices, together with a great part of Bridgetown, in 1860. It contains returns of the rainfall of the island from 207 stations, compiled by Dr. Walcott, who has re-established the system of observation which was begun by the late Governor, Sir Rawson Rawson, and carried on by him till his administration ceased at the end of 1875. The stations are grouped into districts and parishes, and the mean rainfall of each is given, which is perhaps the most useful for agricultural purposes, but is not of so much scientific value as if the returns from each station were given separately.

The Meteorology of Croydon. A paper read before the Croydon Microscopical and Natural History Club. By Mr. GEO. CORDEN. 8vo. Croydon, 1878.

This paper is a very full digest of Mr. Corden's observation at Croydon during the 10 years, 1867–1876. It is divided into seven parts—Temperature, Diurnal Range of Temperature, the Dew Point, Cloud, the Winds, Atmospheric Pressure, and Rainfall, and each part contains copious tables of the mean results and the extremes registered. Unfortunately, the thermometers were only placed in shade of a wall facing north, so that the observations are not comparable with those obtained from instruments mounted in properly exposed screens. The observations of temperature and rainfall are carried back to 1848 by the addition of the observations made by Dr. Westall.

Modern Meteorology. A series of Six Lectures, delivered under the auspices of the Meteorological Society in 1878. Illustrated. London: Stanford. Cloth, 8vo., xii., 186 pages.

The first time that we have an idle five minutes at the British Museum we will try to find under what name the authorities have catalogued this book; no names appear on the title-page, or one might expect to find it catalogued under the first name, and although there is a preface there is no signature to it. Of course this is not a matter of any moment, but we really do not know where to put it on our own shelves; perhaps the best place would be among the Gr's, since it was solely through the President of the Meteorological Society (Mr. Greaves) that the lectures were delivered; but his name is not mentioned, and therefore no foreign catalogue, and certainly not that of the British Museum, would place it in the same position. We give it up, and will be guided by the British Museum authorities.

The editor of this magazine having given one of the lectures, it

would be contrary to our practice to insert any opinion upon the work, but we cannot commit any impropriety in stating the titles of the lectures and by whom they were given, or in expressing our opinion that the "get up" of the book is extremely good.

	LECTURE.	LECTURER.
1.	The Physical Properties of the Atmosphere	R. J. Mann, M.D., V.P.M.S.
2.	Air Temperature, its distribution and range	J. K. Laughton, MA, F.M.S.
3.	The Barometer and its uses, wind and storms	R. Strachan, F.M.S.
4.	Clouds and Weather Signs (*illustrated*)	Rev. W. Clement Ley, M.A., F.M.S.
5.	Rain, Snow, Hail and Atmospheric Electricity (*illustrated*)	G. J. Symons, F.R.S., Sec.M.S.
6.	The nature, methods, and general objects of Meteorology	R. H. Scott, M.A., F.R.S., For Sec. M.S.

In conclusion, we advise the perusal of this work simultaneously with that of "Seven Lectures on Meteorology," by Luke Howard, F.R.S., published in 1837. The titles of the lectures were :—

1. Constitution and properties of the atmosphere.
2. Constant and variable winds, climates and seasons.
3. Cycles of temperature; increase and decrease of the heat through the seasons; mean and extreme temperatures of the years, months and climate.
4. The Barometer, its principal, construction and variations; relation of these to the weather and seasons; evaporation and the hygrometer; rain and its proportion in different seasons.
5. The Clouds: their varieties or modifications of form and structure; the manner of their production, suspension and resolution into invisible vapour, or descent in rain, snow, and hail; thunderstorms and their effects; whirlwinds, water spouts.
6. Electricity of the atmosphere, and of clouds, especially of the rain cloud; sparks from showers; corposants; manner of the formation of rain, hail, and snow; the avalanche; dew and hoar frost; the iris, corona, halo; the anthelion, parhelion, paraselene; the rainbow and meteorological glory.
7. Colour of the sky, cyanometer; night, twilight, daylight; shooting stars and fiery meteors; meteorolites, or stones falling through the air; ignis fatuus so called; aurora borealis; conclusion.

On the Meteorology of Bute, for the year ending 31st December, 1878. By JAMES KAY. 8vo. Rothesay: 1879.

A COMPACT 8vo. pamphlet, giving the results of careful observations in well-arranged tables of rainfall, temperature, direction of wind, and also notes on meteorological and phenological phenomena. The station does not, however, seem to be fully equipped with instruments, as there are no barometrical or hygrometrical observations.

On the Horizontal Visual Penetrability of the Atmosphere, or the Extreme Limits of View along the Earth's Surface. By ALEXANDER CRUICKSHANK, M.A., Aberdeen (From the "Journal of the Scottish Meteorological Society".—Vol. V.

THE observations on which the above paper is based are of a novel and very interesting character: the observer selected six elevated points at distances of about 5, 10, 20, 30, 40, and 50 miles from his

station, and by means of these estimated the extreme limits of view in the middle of each day for 21 years.

The paper concludes with a summary of the principal facts deduced from the observations, a few of which are well worth reproduction.

"The mean daily distance seen is only 25 miles.

"The mean number of days in the year on which a distance of 50 miles can be seen is 90.

"The greatest mean daily distance seen, increases for each month from January to July, and then decreases again from July to January. This monthly increase and decrease in the greatest mean daily distance seen, corresponds respectively with the monthly decrease and increase in the humidity of the air.

"There is no regular relation between the monthly variation in the mean distance seen, and the mean monthly amount of cloud in the sky."

STRATUS AND CIRROSTRATUS.

To the Editor of the Meteorological Magazine.

SIR,—There is, and a very excellent thing it is, a greatly increased interest in the movements of the clouds in the upper regions of our atmosphere. To the Rev. Clement Ley the honour of this is chiefly due; indeed clouds seem to exist, for him, too much for the sake of the upper currents, to judge from his lecture in the recently-published "Modern Meteorology." In consequence, the fact that clouds of the same modification are not found always at the same precise level is a great stumbling block in searching records for movements of clouds in the higher regions, and for this Mr. Ley has a remedy. Cirrostratus being a cloud appearing over a wide range of altitude, is only to be called by its own name in the very highest region, so high that, from the description, "interlacing fibres of more or less cirriform cloud," true cirrus is probably meant.* Stratus having been "unfortunately" ground fog from the beginning is to rise in the sky, and to do duty for any clouds which "tend to arrange themselves in a horizontal bed or layer."

Mr. Ley is "not attempting to reform," but avers that the varying habitat of Cirrostratus has made "confusion worse confounded." One thing is certain, that there is no better way to introduce confusion into a science than to take names already of universal application and pin to them new and widely different meanings. What is really required, and which would more than double the value of their work, is for observers to use words indicating the height of the modification in their registers—three terms, high, mid-region, low, would be sufficient.

Tottenham. W. DILLWORTH HOWARD.

* Cirrus. Parallel, flexuous, or diverging fibres, extensible by increase in any or in all directions. Howard's "Essay on the Modifications of the Clouds." Edition, 1865; fol. 3.

EXCESSIVE RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—I have seen several paragraphs in the papers speaking of the excessive rainfall this season, and as these statements do not correspond with my experience here, I send you my record of the rainfall for the past six months as compared with the average of the previous seven years, and also with the wet year, 1872.—Yours truly,

SAMUEL KING.

	1879.		1872.		Average.
January	1·53	...	5·99	...	4·19
February	2·92	...	3·54	...	2·38
March	1·36	...	4·39	...	2·49
April	1·49	...	2·42	...	1·67
May.....	2·19	...	1·45	...	2·02
*June	3·61	...	4·94	...	3·22
	13·10		22·73		15·97

* ·88 registered in June, really fell on the morning of July 1st.

During the previous seven years, 1874 is the only one in which less rain fell in the first six months than in the present year.

Elswick Lodge, Lancashire, July 2nd, 1879.

WITH reference to the above subject we have been favoured with many notes and tables, but, unfortunately, we have not room to insert them. We have, therefore, prepared the following abstract, whence (and from additional evidence) we are induced to believe that the excess has been greater in London than in the country generally. In the North-Western counties and in the lake district, there has been a great deficiency :—

	London.		Maidstone.		Banbury.		Bodmin.		Orleton.		North Shields.		Seathwaite.	
	Total	Diff.	Total	Diff.	Total.	Diff.	Total.	Diff.	Total.	Diff,	Total.	Diff.	Total.	Diff.
Jan....	2·87	+ ·92	2·40	+ ·36	2·37	+ ·28	6·55	+1·36	2·31	— ·22	1·29	— ·82	3·34	-13·02
Feb....	3·77	+2·55	2·97	+1·75	2·89	+1·46	6·27	+3·48	3·35	+1·78	3·05	+1·52	7·93	—3·45
March.	·91	—1·17	·57	—1·59	1·02	—1·18	1·28	—2·47	·81	—1·61	·80	—1·55	12·14	—1·26
April..	2·72	+1·59	2·85	+1·70	3·01	+1·85	3·49	+1·79	2·96	+1·42	2·35	+1·04	4·76	—2·14
May...	3·46	+1·06	2·95	+ ·71	2·91	+ ·69	2·05	— ·41	2·88	·00	2·28	— ·36	4·67	—4·87
June..	4·76	+1·71	2·77	+ ·05	4·66	+1·38	8·54	+4·50	6·03	+2·51	3·64	+ ·90	9·93	— ·58
Total..	18·49	+6·66	14·51	+2·98	16·86	+4·48	28·18	+8·25	18·34	+3·88	13·41	+ ·73	42·77	-25·32
Diff. per cent. of mean		+56		+25		+35		+42		+26		+6		—37

THE WEATHER IN JUNE.

The weather during the first week of the month partook of the same character as the last week of the preceding month, being unsettled and showery, but it was milder than it had been for many months. Throughout the week pressure was highest over the South of France, and numerous depressions passed from W. to E. over the West of Europe. Their courses lay generally over these islands, and on some occasions were even so far south as the North of France. The wind therefore blew from all quarters, and the weather was rainy or fair according to the distance of the several disturbances from these islands.

There was but very little change during the second week from the continuously unsettled weather which had prevailed for so long before. The barometer was as a rule high over Central and Southern Europe, and depressions, sometimes large and at others small, but on every occasion shallow, passed from S.W. to N.E. across our islands. The winds consequently ranged between S.E., S. and S.W. or W. The weather, though occasionally bright, was for the most part dull, rainy and foggy. A good deal of thunder was reported during the former half of the week.

From the 15th to the 18th the weather remained in the same unsettled state. Depressions of comparatively little importance with regard to the force of winds which accompanied them, passed across the British Isles, occasioning variable breezes, cloudy skies, and rain. On the evening of the 18th, however, a considerable fall of the barometer occurred in the W., and a much deeper depression than those which had preceded it, advanced to Ireland, causing moderate to fresh gales from S., and rain at many places in the West of England and Scotland.

On the 20th the depression passed away to N. or N.N.E., and a recovery in pressure took place generally with S.W. breezes and fair weather, but on the next day a fresh and brisk fall began, and another disturbance was shown to the westward of Ireland. During this day moderate to fresh gales with rain and sharp squalls were experienced in many parts of the country.

The remainder of the month continued in the same unsettled condition. On the 22nd a rather deep and well-marked depression passed away eastward over the North Sea, and fresh N.W. to W. winds prevailed, with cloudy squally weather. On the 23rd a brisk fall of the bar. was taking place, and fresh S. winds prevailed in the W. with generally cloudy skies and rain, while on the 24th and the early part of the 25th the weather was governed by a large shallow depression, which passed slowly across Scotland and the North Sea to Norway. On the 26th another disturbance passed northward along our western coasts, causing fresh S. to S.W. winds, while on the 27th a much larger and more important depression approached us from the Atlantic, bringing strong gales to Ireland and fresh winds and unsettled weather to most other places. On the 28th this disturbance was passing off; pressure was recovering generally; the wind veered to W., and the weather improved somewhat.

The weather was moderately fine on the 29th, but there was evidence in the west of the approach of another cyclone. This appeared on the last day of June, and had its centre (29·1) over Ireland on the 1st of July.

The general conditions of this month may be summed up in three words—squally, showery, cloudy. A low temperature has prevailed throughout the month; as regards England, the lowest temperatures were in the S.W. and W. Rain has been reported every day during the month, never from less than eleven stations in Western Europe, and this on but one occasion (19th). On the 8th, 12th, 16th, 17th, 20th, 22nd, 23rd, and 26th the falls were heavy at many places in these islands.

HORACE E. MILLER.

SUPPLEMENTARY TABLE OF RAINFALL IN JUNE, 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	2·67	XI.	Port Madoc	4·87
,,	Littlehampton	5·23	,,	Douglas	4·41
,,	Horsham, Swallowfield.	...	XII.	Carsphairn	6·29
,,	Hastings, Manor House	4·33	,,	Melrose, Abbey Gate	4·89
,,	Hailsham	3·70	XIV.	Lanark, Baronald	...
,,	I. of W., St. Lawrence.	4·15	XV.	Islay, Gruinart School.	3·25
,,	Strathfield Turgiss	4·91	XVI.	St. Andrew's, Cambo	3·55
III.	Great Missenden	5·50	,,	Aberfeldy H.R.S.	...
,,	Winslow, Addington	4·95	XVII.	Tomintoul	3·70
,,	Oxford, Magdalen Col.	4·63	,,	Keith H.R.S.	3·20
,,	Northampton	4·31	,,	Forres H.R.S.	3·89
,,	Cambridge, Merton Vil.	5·42	XVIII.	Strome Ferry H.R.S.	2·07
IV.	Harlow, Sheering	4·33	,,	Lochbroom	2·09
,,	Diss	3·37	,,	Auchnasheen H.R.S.	2·57
,,	Swaffham	4·53	,,	Tain, Springfield	2·28
,,	Hindringham	3·23	,,	Loch Shiel, Glenfinnan.	4·52
V.	Salisbury, Alderbury	4·95	,,	Dalwhinnie H.R.S.	8·26
,,	Calne, Compton Bassett	5·20	XIX.	Lairg H.R.S.	...
,,	Beaminster Vicarage	7·27	,,	Altnabreac H.R.S.	2·45
,,	Dartmoor Prison	15·89	,,	Watten H.R.S.	1·60
,,	Langtree Wick	6·77	XX.	Fermoy, Glenville	8·82
,,	Lynmouth, Glenthorne.	6·47	,,	Tralee, Godfrey Place	...
,,	St. Austell, Cosgarne	8·34	,,	Cahir, Tubrid	6·76
,,	Taunton	5·50	,,	Tipperary, Henry St.	5·81
VI.	Bristol, Ashleydown	5·20	,,	Newcastle West	4·11
,,	Wem, Sansaw Hall	...	,,	Kilrush	3·49
,,	Cheadle, The Heath Ho.	6·25	,,	Corofin	4·87
,,	Bickenhill Vicarage	5·25	XXI.	Kilkenny, Butler House	5·44
VII.	Melton Mowbray	4·19	,,	Ballymore, Eustace	...
,,	Horncastle, Bucknall	4·09	,,	Kilsallaghan	5·55
VIII.	Walton-on-the-Hill	3·91	,,	Navan, Balrath	4·62
,,	Broughton-in-Furness	3·58	,,	Athlone, Twyford	6·25
IX.	Wakefield, Stanley Vic.	3·90	,,	Mullingar, Belvedere	6·98
,,	Ripon, Mickley	4·24	XXII.	Ballinasloe	4·74
X.	Gainford	3·60	,,	Clifden, Kylemore	7·70
,,	Haltwhistle, Unthank.	4·28	,,	Crossmolina, Enniscoe.	6·79
,,	Shap, Copy Hill	6·19	,,	Carrick-on-Shannon	5·51
XI.	Llanfrechfa Grange	8·53	,,	Dowra	5·04
,,	Llandovery	6·84	XXIII.	Rockcorry	5·78
,,	Solva	5·04	,,	Warrenpoint	6·99
,,	Castle Malgwyn	6·30	,,	Newtownards	6·32
,,	Rhayader, Nantgwillt.	8·89	,,	Larne, Carnlough	5·00
,,	Carno, Tybritle	6·79	,,	Bushmills	3·46
,,	Corwen, Rhug	4·02	,,	Buncrana, Rockfort	5·61

ERRATUM.—In the Supplementary Table for May, on p. 77, the fall at Carno should have been 2·35 in., not 2·07 in.

JUNE, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	4·76	+ 1·71	1·07	24	22	74·0	14	40·6	4	0	0
II.		Maidstone (Hunton Court)	2·77	+ ·05	·50	2	16	...	...	...	...	...	...
,,		Selborne (The Wakes)	6·80	+ 3·57	1·37	30	25	68·0	2	42·0	5	0	0
III.		Hitchen	5·22	+ 2·58	·68	13	25	67·0	14*	42·0	1	0	...
,,		Banbury	4·66	+ 1·38	·66	30	26	70·0	20	39·0	5	0	...
IV.		Bury St. Edmunds (Culford)	4·06	+ 1·48	·88	5	22	78·0	8	37·0	4	0	0
,,		Norwich (Sprowston)	...	...	...	...	...	...	...	...	...	...	...
V.		Bridport	5·93	+ 2·69	1·12	30	19	...	...	...	...	...	...
,,		Barnstaple	5·74	+ 1·62	1·05	30	23	71·0	12†	41·0	4	0	...
,,		Bodmin	8·54	+ 4·50	1·48	30	25	67·0	20	45·0	7	0	0
VI.		Cirencester	4·87	+ 1·49	·91	30	23	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	5·21	+ 2·10	·99	11	25	69·0	14‡	37·0	2¶	0	0
,,		Tenbury (Orleton)	6·03	+ 2·51	·98	30	26	69·8	20	35·0	5	0	0
VII.		Leicester (Town Museum)	4·34	...	·79	7	24	68·3	28	39·5	2,5	0	3
,,		Boston	4·18	+ 1·99	1·09	11	20	74·0	10	39·0	5	0	...
,,		Grimsby (Killingholme)	3·44	...	·77	7	18	69·0	19	40·5	5	0	...
,,		Mansfield	4·77	...	·76	7	23	69·7	20	36·1	5	0	0
VIII.		Manchester (Ardwick)	4·66	+ 1·58	·70	8	24	75·0	14‖	39·0	5	0	0
IX.		York	3·31	+ 1·21	·70	7	18	...	...	...	...	...	...
,,		Skipton (Arncliffe)	6·44	+ 2·34	1·30	30	21	...	...	...	...	...	..
X.		North Shields	3·64	+ ·90	·82	7	18	66·0	15§	39·8	1	0	0
,,		Borrowdale (Seathwaite)	9·93	— ·58	1·81	27	23	...	...	...	...	..	...
XI.	WALES.	Cardiff	6·48	...	1·64	30	23	69·0	13	41·4	4	0	0
,,		Haverfordwest	7·39	+ 3·74	1·25	30	17	68·0	15	36·4	1	0	0
,,		Aberdovey	...	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	3·26	+ ·97	·80	7	18	67·8	19	41·8	5	0	...
XII.	SCOTLAND.	Cargen	5·65	+ 2·21	·99	7	19	69·6	11	40·2	1	0	...
,,		Hawick (Silverbut Hall)	3·74	...	·66	21	22	...	...	...	...	...	...
XIV.		Annanhill	...	...	...	...	...	...	...	...	...	...	...
XVI.		Kilmory	4·03	...	·91	19	19	...	...	34·0	1,3	0	...
,,		Mull (Quinish)	2·84	...	·85	27	16	...	...	...	...	...	..
,,		Loch Leven	5·00	+ 2·15	1·00	8	17	...	...	...	...	...	...
,,		Tyndrum (Ewick)	...	...	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	4·27	+ 1·74	·79	7	20	71·0	29	38·0	1	0	...
,,		Braemar	3·23	— ·21	·46	10	20	67·0	15	36·3	2	0	3
XVIII		Aberdeen	2·55	...	·67	21	20	69·1	28	40·4	1	0	0
,,		Portree	2·10	— 2·68	·67	27	14	...	...	...	...	...	...
,,		Inverness (Culloden)	3·55	+ 1·63	1·01	4	15	70·8	19	39·0	14	0	0
XIX.		Dunrobin	2·95	+ 1·38	·63	8	17	64·5	30	39·5	1,2	0	...
,,		Sandwick	1·38	— ·16	·70	3	8	65·5	21	41·4	1	0	0
XX.	IRELAND.	Cork	4·88	...	·70	9,16	19	...	...	...	...	...	...
,,		Caherciveen Darrynane Abbey	4·32	...	·70	30	24	...	...	...	...	...	...
,,		Waterford	...	...	...	...	...	...	...	...	...	...	...
,,		Killaloe	5·62	+ 1·99	1·34	16	22	75·0	25	34·0	2	...	...
XXI.		Portarlington	5·20	+ 1·95	1·07	16	25	67·5	15	37·5	4	0	..
,,		Monkstown, Dublin	...	...	...	...	...	...	...	...	...	...	...
XXII.		Galway	5·67	...	·69	15	24	66·0	19	37·0	2	0	..
XXIII		Waringstown	4·54	...	·61	10	22	75·0	15	35·0	1	0	1
,,		Edenfel (Omagh)	4·81	...	·62	30	21	66·0	19	37·0	1	0	...
,,		Ballyshannon	...	...	...	...	...	...	...	...	...	...	...

* And 17. † And 13. ‡ And 17, 20. ‖ And 28. § And 20, 28. ¶ And 4, 5.

\+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON JUNE.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

SELBORNE.—The greatest number of wet days in June within my record or recollection.

HITCHEN.—The wettest June for 30 years, and the coldest except June, 1860.

CULFORD.—This month has been distinguished by a remarkable absence of sunshine, excessive rainfall, and comparatively cold and ungenial weather; mean temp. 58°·1 Easterly winds prevailed during 7 days, T on 5 days.

BODMIN.—The heaviest rainfall ever recorded in June; mean temp. 60°·1.

CIRENCESTER.—A cold wet ungenial month, not one real summer's day during the whole time. Everything very backward.

SHIFNAL.—A very wet month, R daily with five exceptions, T on 4 days, wind as persistent from S.W. and S.E. as from N. and N.W. in May. Temp. very low, the max. never exceeding 69°, and the min. only once being as high as 55°. Farmers on strong soils could not get in their swedes or cut their hay till the close. No butterflies except a few white and orange-tip. Ash only bursting into leaf on 5th. Apples, of which there was a great show, all falling off.

ORLETON.—A very cold and rainy month, only 4 days without a measurable quantity of R, and the largest total (6·03 in.) for the month during 49 years, except June, 1860. Heavy TS on 3rd, 11th, and 24th, and distant T on 6th 12th, 13th, and 29th. Floods frequent on the brooks and river Teme; mean temp. about 3°·5 below the average, and lower than that of any June for 20 years, except June, 1871. Up to the 1st of July this year, the max. temp. in shade has never reached 70°, a case without parallel during the last 54 years.

BOSTON.—Rainfall about double the average, and after the heavy fall of 1·09 in. on the 11th, water was standing for several days on land where it is seldom seen even in the wettest winter. The river Witham has been very full, and several hundred acres in the upper valley flooded. All vegetation at least a month behind, prospect for fruit and corn very bad, gooseberry and currants which promised an abundant crop, are being destroyed by caterpillars, and slugs are very numerous and destructive.

KILLINGHOLME.—Month cold, wet, and cloudy, crops in field and garden extremely backward, and presenting a deplorable appearance; and slugs, which it was hoped would have been killed by the long winter, have been more destructive than ever.

MANSFIELD.—Thunderstorms on 8th, 12th, 17th, and 29th; T on 9th.

MANCHESTER.—A remarkably wet month. but on the whole a growing one, the season being late.

NORTH SHIELDS.—Thunderstorms on 2nd, 9th, 10th, 21st, and 25th.

SEATHWAITE.—Beginning and end of month cold, middle of month milder.

WALES.

HAVERFORDWEST.—A very wet month, the rainfall being 4·65 in. above the average of 31 years, and the greatest amount recorded in June during that period, the nearest approach to it being June, 1860. when the fall was 6·70 in. Temp. below the average, though there were several fine bright days, the R falling mostly in the night. Weather very wet and wild from 26th to end of month. Corn crops look yellow and tall, turnips cannot be sown, and there is no prospect of cutting hay yet.

LLANDUDNO.—Rainfall much above, and mean temp. 1°·5 below, the average. With the exception of the first five days, which were remarkably fine, the month was changeable, dull, and showery, there being only 12 fair days in all. Mountain Ash in flower on 3rd; TS on 8th, T on 11th.

SCOTLAND.

CARGEN.—Dull, overcast weather, with a rainfall much above the average, sunshine much wanted. Mean temp. 56°, nearly 1° below average; TS on 8th and 21st, T on 9th, 11th, and 25th.

SILVERBUT HALL.—Though the month was rather cold, and there was little sunshine, the country never looked more beautiful, the May flowers being in great profusion, and the blossom on the fruit trees very abundant. T and H on the 1st, 9th, and 21st.

QUINISH.—From 1st to 6th cold and dry, from 9th to 19th warm and dry, dry N. and E. winds prevailing until near the end of the month, with occasional sudden shifts to S.W. with R.

BRAEMAR.—S on hills on 1st, TS on 10th and 14th, and T on 15th and 24th.

PORTREE.—A very hot and dry month, vegetation made rapid progress.

CULLODEN.—Low temp. and want of sunshine. White and pink May, Rhododendrons, and all forest trees late in flowering.

DUNROBIN.—Weather cold and showery. Vegetation late.

SANDWICK.—The rainfall was much below the mean of the previous 38 years, only ·39 in. having fallen since the 3rd, the farmers are longing for R. Weather generally fine during the latter part of the month. There was a gale of 40 miles an hour from noon to 1 p.m. on the 19th, and another of 40 miles from 1 to 3 p.m. on the 27th.

IRELAND.

DARRYNANE ABBEY.—First half of the month fine, but not warm, second half wild and stormy, crops looking well but are very backward.

KILLALOE.—All crops fully a month late, no hay cut by the end of the month.

WARINGSTOWN.—Wet and generally cold; much difficulty in handling the green crops, but the grain fields are still looking well and only want sun now to be a more than average crop.

OMAGH.—With the exception of the first week, which was dry and cold, the weather of the month was wet and inclement beyond precedent. All vegetation is a month late, and although fairly luxuriant, there is no appearance of the heat or sunshine necessary to bring it to maturity.

POLLEN SHOWERS.

To the Editor of the Meteorological Magazine.

DEAR SIR,—The accompanying letters, clipped from the *Dublin Daily Express* of June 19th and 20th, may prove interesting to the readers of the *Meteorological Magazine*, if you can find space for them. Pollen showers would seem to have been of frequent and widespread occurrence last month.—Yours truly, J. W. MOORE, M.D.

40, *Fitzwilliam Square West, Dublin, July 2nd*, 1879.

[We gladly insert Dr. Moore's letter in order once more to explain the cause of the "Showers of Sulphur" which were reported from various localities during June, but we have not space for the newspaper extracts. A very full description of a "Shower of Sulphur," together with the usual reference to the distance from Etna, appeared in the *Dublin Daily Express*, to which journal some of the "sulphur" was also sent. The Editor placed it in the hands of Dr. Moore for examination, and even with a low power microscope it was immediately seen to be merely pollen grains from (probably) some member of the Pine family.—ED.]

MISCELLANEOUS FOREIGN NEWS.—The heat is so great at Madrid, that the Deputies are taking flight, and the Session will probably be closed as soon as the address is voted.—Snow fell last week on the Jura, a circumstance at this time of the year almost unprecedented.—In a thunderstorm in Appenzel, a few days ago, a farmer and ten of his cows, one of which he was milking, were killed by lightning.—*Paris, July 8th.*

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLXIII.] AUGUST, 1879. [PRICE FOURPENCE. or 5s. per ann. post free.

THE THUNDER AND HAIL STORM OF AUGUST 2ND–3RD.

THE extreme severity of this storm, and the very great destruction of property which it caused have combined to call considerable attention to it, and to the phenomena which are in many respects of great interest.

Thanks to the ready help of many of our correspondents, we have received a considerable number of reports respecting the storm, and most of these we print on subsequent pages. But it is necessary that we should receive much more information before we can write the full history of the night of August 2nd-3rd. We, therefore, ask all our readers to collect, before it is too late, all the information which they can respecting the storms of that night, in any part of the country. Storms of T, L, and tremendous R occurred in many parts of the southern half of England and Wales, details of which will be found on pages 110 to 113.

It rests with our readers to determine what amount of information we shall receive, and we know what that store may be. Newspaper reports are always acceptable, especially when corroborative evidence accompanies them. We also desire the loan of the records, or copies of the records, of any self-recording instruments, especially barometers and anemometers for that night.

On the present occasion we confine our remarks to that which may be designated the Richmond Hail Storm; but we strongly recommend our readers to peruse the reports of our correspondents from other districts, for many of them are of very unusual interest, *e.g.*, the fall of 3·92 inches of rain in four or five hours at Granchester Mill, Cambridge.

THE RICHMOND HAIL STORM.

Personal.—We do not like putting personal matters in front, but people are so loth to believe in exceptional phenomena, until they witness them themselves, that it is always well to state precisely the authority for the facts recorded.

Having, by its bearing and by the time interval of some of the L and

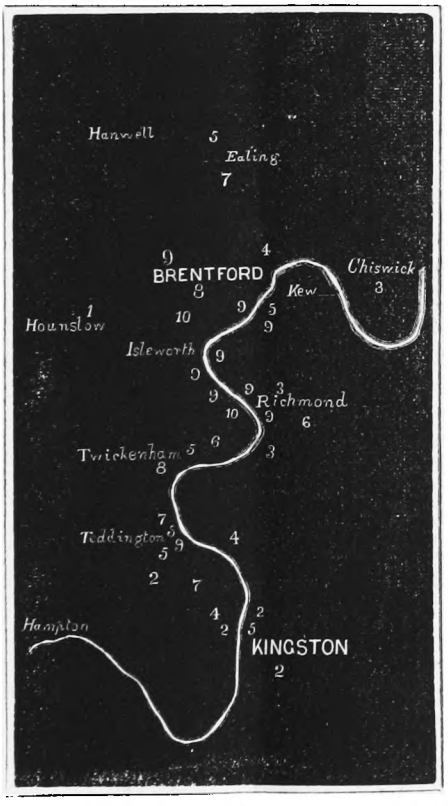
T, fixed one of the storms as being near Mortlake, we were quite prepared for the report of destruction at the adjacent town of Richmond, which appeared in the morning papers on August 4th. Having telegraphed enquiries to a few of our correspondents in the district, we started at once for Richmond, and spent the whole day mapping down the damage done between Brentford and Kingston. During that day also Miss E. A. Ormerod, of Spring Grove, very kindly had enquiries made as to the damage at various places between Brentford and Hounslow. Miss Ormerod's report, those from the other observers, and the results of our own observations, were during the evening all laid down on the ordnance maps, and the next day our two assistants went over nearly 30 miles of the roads in the district, checking off the various entries previously made, and adding very materially to our knowledge of the limits of the damage. In the appended details of damage, entries made by ourselves are simply entered as "Ed.," reports by our observers bear their signatures, and extracts from newspapers state their origin. Amid all the mass of newspaper statements we have not detected one misrepresentation, and the reports of our correspondents contain more startling facts than any in the newspapers. We have, therefore, left almost all the descriptive matter as given in the local paper, the *Richmond Times*. We could not pay it a higher compliment.

Value of Property destroyed.—We may as well dismiss this first, as it will tend to give a general idea of the storm, and will leave us clearer for other matters. No amount can be specified, because even had we all the glaziers' bills they would represent but a small part of the total loss, for when a conservatory is smashed or a drawing-room window burst in, the cost of the glass by no means represents the total damage. £1,000 will, in these days of cheap glass, pay for many superficial feet, yet we know of two establishments where the repairs will cost at least twice that sum; and we are certainly within the mark in stating that there are dozens of places where it will cost £100 and upwards. Judging from our own inspection, from that of our assistants, and from other indisputable evidence, we believe that the total cost of replacing glass alone will be between £20,000 and £30,000.

Area of Damage.—We incline to the belief that this hailstorm was nearly as remarkable for its large extent as for the size of the hailstones, or the damage done, but we do not speak *ex cathedrâ*, and state merely the impression left upon our minds by the many analogous scenes of ruin which we have visited. The usual area which we should assign to an English hailstorm is a mile or two long and a few hundred yards broad. But even assuming that the storm at Harrow (see p. 110), and another which broke many thousand squares of glass near Reigate, are unconnected with the present one, we still have damage from one mile south of Kingston to a little north of Ealing, or seven miles from south to north, and an average breadth

of two miles. This gives an area of damage equal to fourteen square miles, which far exceeds any case that we can recollect.

The damage produced depends on so many causes, the thickness of glass, the size of panes, the angle of roofs, the force of the wind, the exposure of the premises, &c., that it is very difficult to judge from the damage of the intensity of the storm, but this was the all essential element for us to determine, and the annexed sketch map gives an epitome of the results. The figures placed upon the map state our opinion of the damage done to glass, relatively to the maximum possible; total destruction is represented by 10, and 9 is so near to total destruction that most persons would describe a place as "utterly smashed" which we should enter as 9. Of course 1 indicates the least amount of damage. As additional information is still arriving, we have not marked upon the map the limit of destruction, but, roughly speaking, it is an oval as long and as broad as the woodcut would contain.



Size of the Hail.—We have given on page 115 a few notes as to the relations between the size and the weight of hailstones. We here quote the statements of our own correspondents as to size and weight, and though in order to save space we do not also classify the

newspaper reports as to size, it will be found that they and our own are mutually confirmatory.

GOMER HOUSE.—"A hail-bolt which fell through a carpenter's window was found by him to be 4½ in. in length." This was the largest of which we have heard, but we quite believe in the statement. Assuming that the real length was 4¼ in., it must be remembered that the probabilities are great that it was not measured until some little time after it fell, and thus that it would have decreased in size. We therefore accept the 4½ in.; we are told it was a "bolt" —that implies a cylinder whose diameter is from a sixth to a third of its length—but unless the diameter of this ice bolt had been considerable in proportion to its length, it must have broken across during the shock of breaking through the window; we doubt if an ice cylinder 4½ in. long, would have escaped breakage if less than 1½ in. in diameter; if so, it must have contained 7¾ cubic inches of ice, and may have weighed more than ¼ lb.

HALFORD HOUSE.—"A neighbour gathered some of the stones; the weight of four of them was 1 lb."

DUNSTER LODGE.—"The largest measured was 5¾ in. in circumference after being carried in the hand for about three minutes."

Other evidence as to the size of some of the hail is afforded by the damage done; it is impossible to see a conservatory, roofed in comparatively small panes, with ribbed glass nearly 0·2 in. thick—so strong, in fact, as to suggest walking upon it—with few sound panes left, without feeling that the stones must have been very large, and must have fallen from a great height. Note also the piercing of a zinc roof, the scoring of an iron one as by a sledge-hammer, the injury to the anemometer cups at Kew, and the depth to which the hailstones penetrated the lawns.

Descriptive Accounts.—There are very few remarks requisite respecting the following ample details. In some cases the date is omitted; it is to be understood that all the times mentioned are between 9 p.m., August 2nd, and 9 a.m., August 3rd. The accounts are arranged from S. to N., no separation being made between those on the west of the river, which are in Middlesex, and the others, which are in Surrey.

MITRE HOTEL, HAMPTON COURT.—We had no damage done to our premises, and cannot hear of any being done at Hampton. At Hampton Court, Ivy House had about 270 panes of glass broken in the conservatory and greenhouses. Hampton House, about 20 in the conservatory and house, and 3 or 4 panes of glass broken at the large vine house in the Palace Gardens, and slight damage in the Kitchen Gardens. The places near here where most damage happened were Teddington, Kingston, Twickenham, and Richmond. —*Charles Sadler.*

SURBITON HALL, KINGSTON.—Conservatories destroyed.—*Daily Telegraph.*

KINGSTON.—Hailstones were picked up by the inspector of police which measured 5 in. in circumference.—*Daily Telegraph.*

KINGSTON.—A range of glass houses two hundred yards south of Kingston Station was injured, but not very seriously—perhaps one pane broken out of five.—*Ed.*

HAMPTON WICK.—Some houses damaged, but not very badly; much more injury about half a mile N.N.W.—*Ed.*

BUSHY PARK.—A greenhouse near the north entrance was much damaged.—*Ed.*

GOMER HOUSE, TEDDINGTON.—The storm was at its height here at 1.45 a.m. The hailfall lasted for about 15 minutes. The entry was 0·68 in. There must have been more, as the hail-stones jumped out; moreover, a small flint was dashed into the receiver, so that it may have been choked. Unluckily, I did not collect any of the hail-stones, for I thought that before I could dress they might cease. But I watched them from a window, and the grass being lit with incessant blue lightning, I could see them well. They quite covered the ground, and seemed to be at least as large as nutmegs. But I saw that among them, at intervals of a few yards, were much larger ones, which stood out among the rest like rocks among pebbles. And from the sound upon the roof, it was clear that now and then one fell of monstrous calibre. I do not know how far the hailstorm extended, but am told that it was worse to the N.E. than here. It came to us from the N.E. undoubtedly. A neighbour of mine who collected a quart of hail-stones, says that they were as large as full-grown chestnuts, and of that shape. Another person says they were "as big as a watch." I saw one large stone conspicuous on the grass, and glittering in the L like a diamond, which really must have been "as big as a watch." One "hail-bolt" which fell through a carpenter's window was found by him to be 4½ inches in length. My vineries are riddled, even those that face the south; glass facing north is entirely destroyed; I fear that my neighbours have fared even worse. Some of the stones must have had jagged edges; they have cut their own shape out on leaf and fruit. Hundreds of pears are cut clean through. One of the noticeable points seems to be that the storm was preceded by no high temperature, neither was there much wind with it. I have heard much louder thunder, but never seen more continuous or more blue lightning. Saturday evening was cool, with a N.E. breeze, and a few drops of R, but nothing to indicate so violent a storm.. T began about 11 o'clock; but I went to sleep and slept till the H awoke me.—*R. D. Blackmore.*

TEDDINGTON.—This town did not escape the severity of the storm, and much glass is destroyed in all directions.

STONEYDEEP HOUSE, TEDDINGTON GROVE. — The neighbourhood of Teddington was this morning the scene of a most destructive hailstorm, many of the hailstones being an inch in diameter. The storm commenced in the

early part of the evening with T and L, accompanied towards midnight by a tropical downpour of R, which about 1.30 a.m. changed to hailstones of such a size as to break plate glass in my conservatory. I had over fifty squares of rough plate-glass broken. I enclose you a specimen of the glass, which is 3-16ths of an inch thick. At a neighbouring nurseryman's the houses of ordinary glass have been completely wrecked. I sincerely trust this destructive storm is local, otherwise I fear the damage to farm crops will be enormous." —E. BEALE.—*Times.*

TEDDINGTON STATION.—A few lamp-tops smashed.—*Ed.*

STRAWBERRY HILL.—Railway station and street lamps mostly sound.—*Ed.*

TWICKENHAM.—A greenhouse a little to the west of Twickenham escaped entirely, but one south-east of it, near Strawberry Hill, though roofed with heavy glass, was smashed.—*Ed.*

TWICKENHAM.—At about two o'clock a severe storm of R was succeeded by a tremendous downpour of hailstones the size of walnuts, intermixed with others which measured four, five, and six inches in circumference, and which were several ounces in weight, their appearance, when held up to the light, being very beautiful. These were carried by the wind in an easterly direction, and but few panes of glass with which they came in contact were saved, the total smash resulting in the destruction of some thousands of pounds' worth of property. The crash was terrific, the lightning at the same time being of an unprecedented character, illuminating the town in a manner seldom witnessed. The storm continued for upwards of five minutes, during which time many people—some lying in bed, but the majority running with excitement from room to room of their houses in their night garments—anticipated the near arrival of something still more terrible.

Perhaps the greatest individual loss is that which has happened to Messrs. T. and J. Smith, of Richmond-road, who have no less than 13,740 square feet of glass completely pulverised, involving a loss, irrespective of the stock beneath, of between £200 and £300.

Writing from the Orleans Club, a correspondent says:—"The TS, which had been raging for an hour, culminated about half-past one o'clock in a tremendous shower of H. Several of the stones were as large as a potato, and the majority quite as big as plover's eggs. Not a whole pane of glass remains in any of the roofs of the ball-room, dining-room and conservatories. The force and weight of the hailstones may be imagined from the fact of the lawn facing the river being indented with thousands of holes an inch or so in diameter and over an inch deep." We have been shown a specimen of rough plate-glass from the dining-room of the Orleans Club, which is about 3-16ths of an inch thick. The total loss here is stated to be several hundred pounds.

Mr. Bohn's green house, vinery and stove are complete wrecks; about 1,500 panes of glass are smashed, together with 100 ft. of framing, which will probably cost £200 to make good. Many of the windows of Mr. Bohn's residence are also broken.

Mr. Laing, the well-known florist, has also suffered severely. Lady Peel, Mr. Cunard, Mr. Grant-Duff, the Vicar, the Rev. H. F. Limpus, and others in the locality are also great losers. About twenty panes of glass are broken at St. Stephen's Church.

At Montpelier-row the front windows and many frames are completely destroyed on account of facing the storm. Orleans-road, also, has fared almost as badly. This locality appears to have been the very centre of the storm. In some instance slates are perforated, and thick glass broken into clean circular holes as if they had been shot at with bullets. Large boughs are twisted off trees, and outdoor plants and vegetables are cut down as with a knife.

Twickenham Railway Station exhibits but little evidence of the force of the storm except at the signal boxes, where numerous panes of glass are shattered. The front of Albany Hotel, too, though facing due east, escaped the storm's fury. The same, however, cannot be said of the Railway Hotel, where a number of large squares have had uncomfortable ventilating holes made in them. On the Isleworth-road, Messrs. Hawkins and Bennett have extensive glass houses, all of which are more or less wrecked, thousands of squares of glass being destroyed. The storm, indeed, has been a very considerable loss to all the nurserymen and gardeners in the neighbourhood, Mr. Poupart, we observe, being a great sufferer.—*Richmond Times.*

HALFORD HOUSE, RICHMOND.—The storm which visited this place on Sunday morning was the most severe for a great number of years. The rainfall was 0·50 in.; I should imagine it would have been greater had the hailstones been smaller, for I think they must have rebounded from the gauge, as they were of an extraordinary size. From the impressions left on the lawn they appeared to be mostly of a globular shape, but several must have been square and jagged; some of the impressions were nearly 2 in. in depth; and were distinctly visible more than 24 hours afterwards. A neighbour gathered some of the stones; the weight of four of them was 1 lb., so you can imagine somewhat of the size and damaging power of them. A conservatory at the rear of the house was almost a complete wreck, nearly half the glass being smashed; some lights in the kitchen garden in the same state; all windows facing the E. more or less broken. The noise from the falling stones was simply fearful, combined with the T, which was continuous. The radius of the storm seemed to be limited between the Kew-road and Richmond Park, for the trees in the park seemed to be very little damaged, and yet the terrace (which is not far distant), was covered with little branches cut from the trees; the heaviest part of the storm seemed to pass directly over the town from E. to W. The duration of the hailstorm was, I should think, not more than ten minutes or a quarter of an hour; the R, T, and L lasted from 10 p.m. until 3 a.m.—*J. Billett, Junr.*

CHURCH ROAD, RICHMOND.—From 9 p.m. until nearly 3 a.m., we had constant L, the most continuous, for so long a time I ever saw but most of it was very distant; there were occasional downpours of R, with violent gusts of wind from the east and north-east; about 10 minutes to 2 a.m. there was the most violent hailstorm I ever recollect, lasting about 10 minutes; the hailstones were of a very large size, nearly all I saw being in the shape of flattened spheres, like the common acidulated drops, one on my window-sill was 1½ in. in diameter and many others nearly as large. The destruction done was very great, every house looking east and north-east seems to have suffered more or less. Hillside has the appearance of a street in which there had been a riot and the military had fired at the windows; in many cases the stones have gone clean through like a bullet. In Maid of Honor-row, there is not a whole pane of glass.

The Catholic Chapel has nearly every pane broken on one side, all the conservatories not protected from the east are wrecked, and the lawns are punctured with holes from 1 to 2 inches in diameter, and about 3 to 5 deep. As far as I can ascertain, the storm passed over part of Brentford, Kew, Richmond, Twickenham, and Kingston, other districts adjoining have not suffered.—*Arthur Brewin.*

RICHMOND.—The windows all along the river side of Hill-street and King-street have been smashed without mercy. Maid of Honour-row presented a most "attractive" appearance during the whole of Sunday, there being scarcely a perfect window in the front part of any one of the houses. Here the stones had dashed through the windows like rifle bullets, sending the broken glass flying all over the rooms, and fairly driving everybody away from the east side of the house.

It is impossible to exaggerate the scene at Mr. Saddington's nursery, for his piece of ground is more than half covered with frames and greenhouses, in which there is scarcely a whole pane of glass remaining. Houses containing valuable grape vines, with the fruit just ripening, have had their roofs all cut to pieces, and the falling glass has mutilated and quite ruined the rich clusters of grapes; whilst in other houses where the fruit is not so advanced it will now be impossible to ripen it. A large number of frames in which there are flowers are also broken, and the plants themselves are cut to pieces with the glass. Mr. Saddington has done what he could by replacing the broken panes by some glass which happily he had stacked in a portion of his ground, but this will not prevent his being a very serious loser; indeed, we may add that Mr. Saddington will be almost ruined unless he obtains outside help.

The glass houses of Messrs. Steell and Brown are also a complete wreck.

Compared with his neighbours, Mr. Kinghorn was lucky, the total amount of damage to his extensive houses being not more than £10 and £15. The back of Elleker House came in for a share of the mischief; many of the large windows are broken, and the conservatories almost wrecked, the total damage being estimated at between £50 or £100. At Cholmondeley Villa, the residence of Mr. Hilditch, is an arched zinc covering which has been indented in every direction by the force of the hailstones, and in one case one of these heavy ice balls has gone clean through the metal! The residence of Mr. Cave, M.P., has many of its windows and skylights broken, and the extensive range of glass houses are a mass of ruin. Mr. Chancellor's residence, close to the above and near the Green, has also suffered by the breakage of thick panes of rolled glass, and, in addition, upwards of seven hundred panes in his various greenhouses are shattered, whereby plants have been spoiled and other damage has been done.

Messrs. Reynolds' showrooms, which are covered in with plate glass, were in a deplorable condition on Sunday morning, most of the glass being destroyed. At the Richmond Hospital about 40 squares were broken and at the Union Workhouse between 70 and 80. At the railway stations, too, there is great devastation. Mr. Byrne, photographer, had his two galleries almost destroyed, but one of these was quickly repaired and made fit for use. Mr. Tuohy, also, had his studio totally wrecked, his damage being estimated at over £20. He requests us to mention that he is carrying on business as before. An excellent photograph of the wrecked studio has been forwarded to us, showing the extent of the mischief. The Star and Garter Hotel has come off lightly; so, too, has the majority of houses in that neighbourhood, with the exception of Mr. Cook's handsome conservatory, facing the main road, which has been extensively riddled. The skylights of the Vestry Hall are smashed, and on Wednesday at the Petty Sessions, the broken glass fell with a crash, necessitating the speedy adjournment of the magistrates and officials to safer quarters. —*Richmond Times.*

RICHMOND, ROMAN CATHOLIC CHAPEL.—One side faces N.E., and

although not in an exposed position, nearly one-fourth of the panes, both of ground and coloured glass, were broken.—*Ed.*

RICHMOND, CASTLE HOTEL.—The newspapers report—"As far as glass is concerned, a total wreck." This can scarcely be called an exaggeration, for though some panes in the front of the house and all the back windows escaped, the conservatory fared very badly; we do not remember seeing one sound pane of glass in it.—*Ed.*

RICHMOND, POLICE STATION.—Hailstorm occurred at 1.50 a.m. Inspector Pearman drew for us the outline of the usual size and shape of the stones: it is oval, 1·6 in. by 1·3 in.; these, if ¾ of an inch thick would about equal spheres of 4 inches in circumference. Only a few panes of glass were broken at the station.—*Ed.*

ST HELENA TERRACE, RICHMOND.—One or two houses here had overhanging eaves, and by measuring how much they overhung and the distance above which no glass was broken, the angle of the falling hail could be approximately determined, and it comes out only 20° from the vertical. This indicates either the great weight of the stones in that locality, or the absence of as much wind as in other parts of Richmond—the former is believed to be the true explanation.—*Ed.*

ST. MARGARET'S STATION.—Tops of the lamps smashed.—*Ed.*

ST. MARGARET'S.—Mr. Budd and other gentlemen, having glass-houses, are great sufferers, as hardly a pane of glass is left intact. Lady John Chichester's glass-houses, which are extensive, appear to be almost destroyed. Indeed, at the east-end of Twickenham there is scarcely a house but what has left some serious traces of the ravages and destructive force of the storm. Neither did the other parts of Twickenham escape. From every street and lane in the centre of the town may be witnessed evidence of the severity of the storm, and in some of the poorer districts are broken squares, the mending of which, we fear, will be long delayed unless some help is forthcoming by the aid of a local subscription. The grass in some of the gardens has been likened to ground round a rifle butt, so much is it cut up and indented by the falling ice balls, only that the holes are larger than those made by bullets.

The outbuildings, &c., belonging to Mr. G. G. Mackintosh, J.P., Mr. F. Ashton, J.P., Col. Gardiner, and Lady Adeliza Manners, also those at Poulett Lodge, and other well-known residences, are more or less reduced to a wreck, scarcely a single piece of glass being left whole that faced the storm, or that was in a horizontal or standing position. Mr. Richard Clarke's glass houses, we hear, are much damaged, as also his stock.—*Richmond Times.*

ST. MARGARET'S.—"The storm of this morning, commencing about 1.30 a.m., probably unprecedented in the valley of the Thames, will live in the memory of the frightened people north and south of the river at this spot. Never certainly, within the experience of a sexagenarian have we had a truer rendering of the fine lines by Hayley,—

> From clashing clouds their mingled torrents gush,
> And hail and rain with rival fury rush:
> Bolts of loud thunder, floods of lightning rend
> The opening skies, and into earth descend.

The war of elements in my grounds, with its destructive effects, cannot be adequately described. Trees were not, it is true, torn up by the roots; but branches of cedar, ailanthus, and lime were torn off. The most remarkable

feature of the storm was the size of the hailstones, the circumference of some of them being over 5 in. The velocity is indicated by the fact that the indentations on the lawns were in many cases 2in. in diameter and 3in. in depth. In my vineries and flower-houses I have counted over 900 broken panes of glass the total number of panes barely exceeding 1,000. On the balcony of the house, every pane of thick, rough glass in the roof was destroyed, and a stained-glass staircase-window shared the same fate. The market-gardeners in the neighbourhood will be half-ruined and have a claim upon the sympathy of the residents."—G. S. MEASOM, the *Times*.

"CASSILLIS," ST. MARGARET'S:—"The awful T and hailstorm seems to have visited St. Margaret's with greater severity than most districts, and as my house and garden, situated near the edge of the river, came in for its full brunt, a short relation of my experience may not be unacceptable. As to the house itself, the window panes of the whole frontage were smashed by the H, except some extra thick plate glass. An iron verandah, too, was scored as though by the blows of a sledge hammer. In the garden I lost about 2,000 superficial feet of glass, only a single pane remaining unbroken in the roof of the vinery. Even a stout canvas tent succumbed, having its tough roof perforated and torn in many places, a striking instance of the force and size of the hailstones. I can vouch for some having measured from two to three inches in diameter, and the indentations created by them on my lawn and cement terrace are wonderful in their size and number, there being in some places from forty to fifty to the square yard, many of them as big as the bowl of a large wine glass. I may mention, too, the singular circumstance of having picked up a large wild fowl, evidently a sea bird (web footed), but of a species unknown to the many watermen I have shown it to. This unfortunate *rara-avis* had been beaten on to the gravel walk of my garden, and had the appearance of being pinned to the earth, its body riddled with hailstones, and its feathers driven into the ground.—WILLIAM CUNNINGHAM.

KEW OBSERVATORY, RICHMOND.—T and L commenced about 10.40 p.m.; apparently reached its max. about 1.30 a.m. and about 1.50 the H fell, R having been falling since 0.50 a.m. The hailstones averaged from an inch to an inch and a half in diameter, and were here driven by the wind with such force as to break nearly all glass exposed to the N. and N.E., driving the fragments to considerable distances; in one case they marked the paint of a wall ten feet distant from the window. Our radiation thermometers were of course, with one exception, smashed, and the anemometer cups considerably knocked out of shape. The damage to the crops and fruit trees is very serious, and the grass regularly ploughed up by the H. I have tried an experiment, and find that with all my strength I can only just throw a stone on to the grass with sufficient force to make an indentation equal in depth to those remaining even now, thirty hours after the storm. It appears to have been very limited in its extent, or at least we were just on its borders; for instance, at my own residence, three quarters of a mile due E., I suffered severely, having conservatory wrecked and several windows broken. Mr. Baker, about a quarter of a mile farther on, states that there was not any material damage in his neighbourhood. In the Royal Gardens, about a mile to the N.E. there are a great many panes of glass broken in the various green-houses, but on the whole they cannot have experienced the full force of the storm. The total R measured by the self-registering gauge was 0·55 in. by the

ordinary one standing beside it 0·72 in. I suppose that the rebound of the stones must account for the difference. 0·43 fell between 1.45 and 1.55 a.m. The barometer was much disturbed, but the photographic trace is not yet ready for measurement. From the reports current, I gather that the most damage was done on the S. side of Richmond and in East Twickenham. None is spoken of at Mortlake and East Sheen. I do not hear of any buildings or trees in the neighbourhood having been struck by the L, and one of my assistants, who watched the progress of the storm, remarked the absence of forked L. The same gentleman timed one continuous roll of T, which lasted twenty minutes without a break.—*G. M. Whipple.*

DUNSTER LODGE, SPRING GROVE, ISLEWORTH.—We had a tremendous TS here on Saturday night which is reported to have done £4000 worth of damage to glass and plants between here and Brentford alone. I counted about 300 panes of glass broken in one row of forcing houses, and the windows of the dwelling houses that face east are shattered as if stones had been sent through them except where the glass is very strong. The cloud currents had been variable during the day, and the wind E; vivid L was first noticed at 11.20 p.m., and from 0.45 a.m. to 2.30 a.m. continued almost without any intermission in sheets of light (sometimes slightly rose coloured) over the whole observable part of the sky; one flash about 2 a.m. being extremely vivid. The T was pretty constant, but not in heavy peals. At 2.10 a.m., following a drop of the barometer, a single long gust of wind. lasting about four minutes, passed by with a heavy rushing sound, audible long before it struck the house, howling in the trees and chimneys. At 2 a.m. the H broke some of our windows, but I could not go out to get any, which I regret; for one cannot be sure from reports, but it is stated that the stones varied from the size of strawberries to pieces 6 inches in circumference. A neighbour of mine says about half of the fall was in hailstones of the usual shape, and half as pieces of ice with jagged edges. The hailstones he estimated as averaging about 3 or $3\frac{1}{4}$ in. in circumference. The pieces of ice were larger: the largest measured was $5\frac{3}{4}$ in. in circumference after being held in the hand for about three minutes; it was clear ice outside and milky in the centre. The fall broke many panes in a conservatory close by, glazed with stout glass more than an eighth (0·17) of an inch thick. I sent our gardener, who is an intelligent man, to obtain information on the subject. It is said to be quite impossible at present, to give any estimate of the damage to plants, but the following statement of the glass broken at a few nurseries close by, shows that the loss will be deplorable.

Mr. Smith, Smallberry Green.....	Damage to glass.....				£30.
Mr. Curtis	2,000	squares	broken,	value	£35.
Messrs. Lee.....	7,000	,,	,,	,,	£200.
Mr. Edwards	7,000	,,	,,	,,	£100.
Mr. Denyer.....	14,000	,,	,,	,,	£200.
Mr. Jordan, Isleworth	5,000	,,	,,	,,	£100.

The different values are presumably attributable to the various sizes of the squares and panes broken.

The greatest amount of damage is at Sion House, where it is said that nearly every pane of glass in the place is destroyed, and the damage estimated at £2,000. From this, and the general reports, it appears that the violence of the hail was mainly along the river.—*E. A. Ormerod.*

BRENTFORD.—Hailstones, or rather large balls of ice (in many instances as big as a teacup) came dashing down with unparalleled violence, splintering glass into fragments, perforating slates and tiles like bullets from a rifle, and even making deep indentations in the ground to the extent of several inches. Daylight broke upon a scene of unprecedented wreck and ruin; the storm in its rage had smitten all alike, and it would be impossible to form anything like a correct estimate of the amount of damage done. At Sion House, Isleworth, the seat of his Grace the Duke of Northumberland, thousands of pounds worth of damage was done, the roofs, and in many instances the sides of the various hot and greenhouses being completely gutted, while irreparable injury was done to the plants, &c., contained therein. The splendid vinery and tropical house especially sustained great injury. The conservatory at Gordon House, Isleworth, the residence of Lord Kilmorey, was considerably damaged, scarcely a whole square of glass being left intact; and at Isleworth House close by, the residence of Mrs. McAndrews, the hailstones are said to have penetrated glass a quarter of an inch in thickness. Every residence boasting of a conservatory or greenhouse suffered in a similar manner, and scarcely a house in Brentford, Isleworth, or Kew Bridge escaped without a broken window. At the Brentford Workhouse, between three and four hundred panes were broken, and the inmates were naturally much alarmed. At Wyke House Asylum, Syon-lane, upwards of two thousand squares of glass were demolished, the loss being very considerable. The greatest sufferers by the storm, however, are the market gardeners and florists, by whom the Brentford and Isleworth districts are largely inhabited. Many of these are never in particularly affluent circumstances; they invest their whole savings in erecting greenhouses and frames, and have to depend almost entirely upon the produce which they raise for their living. To such persons the effect of the storm of Sunday morning, following upon a long and expensive winter and an uncommonly dull season, was most disastrous, and unless something is done to assist them, absolute ruin stares in the face of many. One of the saddest cases is that of Mr. Pestridge, florist, Boston Park-road, Brentford, who had "locked up" in his nurseries the accumulated saving of years, and most of whose greenhouses were completely demolished, upwards of 4,000 squares of glass being smashed to atoms, without counting the panes that were cracked and rendered so useless that it is imperative they should be replaced. A more complete wreck, perhaps, has never been witnessed. Mr. Pestridge states that it will take at least 10,000 feet of glass to repair the damage, which he estimated as over £300, for besides the destruction of glass, the injury to plants, &c., was very great. As an instance of the size of the hailstones, and the terrible force with which they dashed through Mr. Pestridge's greenhouses, we may mention that several flower pots were broken in two, as if they had been dashed to the ground. For the most part the houses facing the North East sustained the greatest amount of damage, but all more or less suffered, none escaping without a number of broken panes. Mr. Wilmot, market gardener, also sustained a heavy loss. Upwards of four or five acres of glass were destroyed, and the fruit trees, &c., considerably damaged. Mr. Mann, market gardener, Twickenham-road, had nearly every inch of glass on his premises shattered, his riddled greenhouses presenting the appearance of having been fired at with grape shot. Hundreds of gooseberry bushes, and acres of currants were also destroyed, the damage amounting to many hundreds of pounds. The market garden of Mr

Meyers, Brentford, suffered to a considerable extent, but it is said the loss will be fully covered by insurance. Strange to relate, but little damage was sustained in the Hounslow and Whitton districts, and Gunnersbury, Chiswick, and Turnham Green, too, escaped almost scathless.—*Richmond Times.*

BRENTFORD.—Much glass broken on the south side of the High-street, but less after leaving the town for Hounslow; great damage near Isleworth station (see Miss Ormerod's report), less towards Hounslow, and two nurserymen just beyond Hounslow report "heavy H but no glass broken."—*Ed.*

ROYAL HORTICULTURAL GARDENS, CHISWICK.—Damage only slight, about 300 squares.—*Journal of Horticulture.*

OSTERLEY PARK.—In the west half no injury was done, but the lodge at the eastern entrance, near Wyke Green, had its windows broken. (We only obtained this intelligence after having laid down the first boundary of damage, and it is curious and satisfactory to find that that line runs through the middle of this park exactly where the above evidence would have placed it).—*Ed.*

GUNNERSBURY.—Saw a conservatory which did not appear to have been injured, and, although informed that *it* was bad there, believe that little real damage occurred.—*Ed.*

ACTON.—Very bad TS, but no damage by H.—*Ed.*

EALING.—The nurserymen at Ealing appear to be the chief sufferers. Thousands of squares of glass were riddled by the hail, and at Mr. Hawkin's establishment the damage is set down at £1,000. The injury to house property was general. At Hanwell, trees were struck by the lightning, and the Central London District Schools damaged to the extent of £500.—*Richmond Times.*

EALING DEAN.—Greenhouse roofs much damaged, especially those facing E., some of which had 50 per cent. broken.—*Ed.*

HANWELL.—A correspondent at Hanwell sends us the following graphic account of the hailstorm of Sunday morning:—"No doubt you will have plenty of information respecting the terrible and awful storm with which we were visited last night; but possibly the following particulars may interest some of your readers. The T and L commenced between eleven and twelve o'clock, and continued with more or less violence until about two, when it was accompanied by, I should think, the most terrific hailstorm that was ever witnessed in this country. Large balls of ice came dashing through the windows like rifle bullets, sending the broken glass flying all over the rooms, and fairly driving everybody away from the east side of the house. After the storm had abated I went into my garden, where I found the ground covered with balls of ice, which looked like a good crop of white potatoes or eggs. I picked some up, and brought them in. The largest measured five inches in circumference, and weighed about three-quarters of an ounce. About twenty minutes after they had fallen I picked up nine and put them in a glass, and to-day I found the water from them weighed six ounces. The grass part of my garden this morning reminds me of the ground round a rifle butt, so much is it cut up and indented by the falling ice balls, only that the holes are larger than those made by bullets. The force of the storm may be imagined by the fact that one of my neighbours has 28 window panes broken on the east side of his house."—*Echo.*

SOUTHALL.—No damage.—*Ed.*

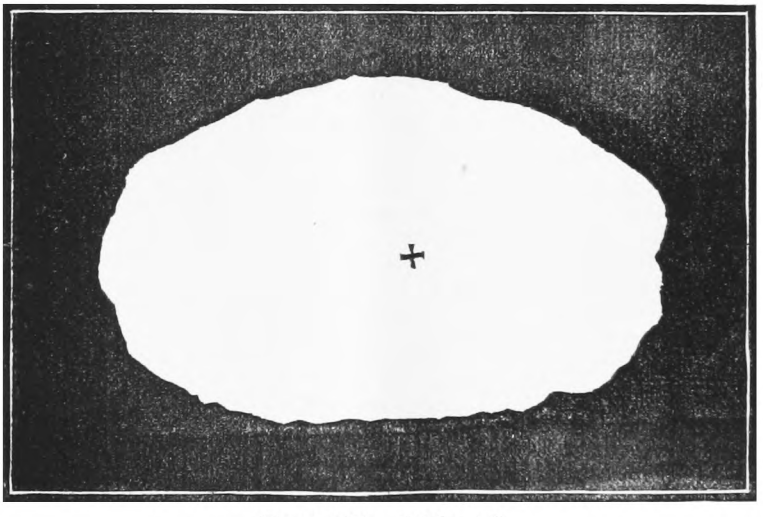
WILLESDEN.—Bad TS, but no H.—*Ed.*

NOTES UPON THE THUNDERSTORMS OF AUGUST 2ND–3RD.

[Although we have added eight pages to the present number, we are still reluctantly obliged to postpone the insertion of many notes already in type.—ED.]

THE KNOLL, HARROW.—A little before 1 a.m., a thunderstorm came up from the direction of London, but never approached very close, and after twice receding so as to be almost inaudible, the thunder returned just after 2 a.m., accompanied by a strong wind and very heavy H from the east. The H lasted between seven and eight minutes, during which time, and until nearly three o'clock, the flashes of distant L were almost incessant. The largest hailstone which came under my notice was the one of which I enclose an accurate outline, taken about five minutes after it crashed through one of the windows. A bason of hailstones collected at haphazard, and fully half-an-hour after they fell, were spherical in form, and varied from half-inch to $1\frac{1}{4}$ inch in diameter. Nearly every window in the town facing east is perforated by round holes, and four conservatories I have seen can hardly muster a dozen panes of glass on their roofs. The lawn this morning shows a series of deep indentations on the average about six inches apart.—*Claude L. Bicknell.*

Hailstone which fell at Harrow, about 2.5 *a.m., August* 3*rd,* 1879.



About $1\frac{1}{4}$ in. thick at *

ENFIELD.—A protracted and most severe TS, accompanied by a magnificent but most extraordinary display of L, occurred here. L was first seen in W. at 9 p.m., with distant T. Soon after 10 p.m. there were almost incessant flashes in S.W. and W., which gradually increased in brightness till, by 11 p.m., the whole sky, from S. to N.W., was ablaze with vivid flashes of L. The storm was severest from midnight till 2.30 a.m. During the whole of this time the

electrical discharges appeared almost continuous. There was a heavy fall of R from 2.16 to 2.25 a.m. The storm gradually subsided after 2.30 a.m., but the L continued till daylight. The rainfall was ·36 in.—*Thomas Paulin.*

THE BOURNE VICARAGE, FARNHAM.—*(a).* Wind E.N.E., force 1·0 to 1·5; at 10.20 p.m. bar. 29·82, L and heavy R till 10.25; *(b)* 10.50, L and distant T till 11.45; *(c)* at 0.10 a.m. another storm from S.W., distant L followed by distant T. The L was almost incessant—scarcely a second of darkness between the flashes, as if the whole heavens were ablaze; the whole landscape was lighted up. It came nearer till *(d)*, at 0.25 bar. 29·75, the storm burst with torrents of R and H. Heavy T till 0.40, when R ceased and storm passed, seeming to divide, one part going N.E., the other due E; L equally vivid in both quarters, with distant T. *(e).* At 1.5, bar. 29·70; heavy R for five minutes, another distinct storm from S.W., not so violent. At 1.35 (bar. 29·79), sky heavily overcast, wind, S.W., rose to force 2·5, and bar. fell in five minutes to 29·69; wind and clouds in scuds; bar. alternately rising and falling; L lasted without any intermission, but becoming more distant till 2.30, when the intervals between the flashes became longer, and I soon ceased to observe. Total rainfall ·56 in the gauge, which I register, while in another, 8 ft. above the ground, it was ·60. This must all have fallen in showers *(a)*, *(d)*, and *(e)*, *i.e.*, in 25 minutes. I never before knew R in the high gauge more than in that on the ground.—*T. W. Sidebotham.*

WERN, STOKE NEXT GUILDFORD, SURREY.—We had an awful TS for two hours or more, from 11 p.m. to past 1 a.m. I never saw the like before—one continued blaze of light, and one continuous roll of T. There must have been three storms raging at the same time. My man woke up and thought his room and the stables were on fire.—*E. W. Mather.*

WOODSIDE, HERSHAM, SURREY.—Only 0·15 in. R in the TS, and 0·20 in. at Cobham. We appear to be out of the track of heavy thunder-rain.—*G. Dines.*

ADDISCOMBE.—9 p.m., frequent L; 11 p.m., L still frequent; 1.15 a.m., vivid L, with loud T; 1.19 a.m., time interval, L and T, 5 secs.; 1.20 a.m., R first began to fall; 1.22 a.m., heavy R; 1.25 a.m., time interval, L and T, 8 secs.; 1·28 a.m., time interval, L and T, 9 secs.; 1.30 a.m., distant and continuous rumbling of T; 1.38 a.m., very heavy R; 1.44 a.m. R almost ceased; 1.45 a.m., R again heavy (large drops of driving R), no H; 1.50 a.m., R ceased; afterwards frequent but distant L and T. R: 9 a.m. to 9 p.m. of 2nd, 0.004 in.; 9 p.m. of 2nd to 9 a.m. of 3rd, 0·121 in.; raining from 1.20 a.m. to 1.50 a.m.; total, 30 min.—*Edward Mawley.*

ROUND OAK, GREENHAM, NEWBURY.—Bar. fell on the 2nd till about 3 p.m., then rose; east wind, fine and hot, then cold, and bar. fell about 8 p.m.; 9 p.m., T, R, and L; 9.20 p.m., moon out, with clouds

passing it from S.W.; R and TS passing to N.W., wind E.; about 11. heavy T, L, and R till about 2.30 a.m.; 3 a.m., moon out and cloudy; total R, 1·57 in.—*J. Ward.*

PURLEY, READING.—R from about 11 p.m. to about 4 a.m., 1·61 in.; heavy T; total rainfall this year, 25·53 in.—*R. Boyle.*

COOKHAM, BERKS.—Tremendous TS, with R and H from N.E. from 0 till 3 a.m., chiefly from 2 till 3 a.m. 2·07 in. of R fell, beside H, which must have leaped out of the funnel, for it seemed as large as marbles at times.—*R. W. Rogers.*

WANSFORD HOUSE, WATFORD.—L most of Saturday evening, but the severe storm with H (which sounded like a few large stones occasionally thrown as in handfuls at our windows) lasted from about 0.30 to 3.30 a.m., and the L appeared almost simultaneously in S.W., N.W., and N.; total R, 1·20 in.—*John Hopkinson.*

MOUNT PLEASANT, RICKMANSWORTH.—Total R, 1·37 in.—*W. B. Butler.*

GREAT GADDESDEN VICARAGE, HERTS.—A most violent TS last night; incessant sheet L; R began to fall between 10 and 11 p.m., and up to 9 a.m. 2·36 in. fell.—*W. T. Tyrwhitt Drake.*

BERKHAMPSTEAD.—We had a most terrific TS (or rather succession of TSS); they commenced before 10 p.m. and continued till about 3.15 a.m. The L was incessant, and the T remarkably loud. Several times it seemed to subside, and returned shortly afterwards with renewed violence. The R measured 2·5 in. I hear that the storm was also very heavy at Hemel Hempsted and Watford.—*Wm. Squire.*

KENSWORTH, HERTS, NEAR DUNSTABLE.—The most terrific storm ever witnessed or remembered by the oldest inhabitant of this parish occurred here on Saturday night. T and L commenced about 9.30 p.m.; at 11.30 an ash tree within 150 yards of this house was struck, the head of the tree being completely split off, the L having pierced to the centre of the stem; the bark was split off and carried away for yards; the storm continued incessantly until daybreak. The R during the six hours' storm was tremendous; the gauge records 2·34 in., the greatest rainfall I have yet measured. The river Ver is supposed to rise at Kensworth, but except in unusual seasons its course is dry, the excessive rain produced quite a torrent in this bed, the water during part of the night being between 5 and 6 feet deep. The roads in the valley were torn up with great force; huge stones hurled along for considerable distances, walls washed down, and one unfortunate farmer has lost 35 pigs by drowning, besides a quantity of other valuable property.—*S. Grace Jones.*

HENLEY-ON-THAMES.—I happened to be at Henley-on-Thames on August 2nd and 3rd, and the TS there was very violent. I did not notice any H, but the R was extraordinarily heavy. There is no rain-gauge kept at Henley so far as I could learn, but from some

rough measurement I made in boats (punts) and pans the fall must have been between 2½ and 3 in. I afterwards ascertained that the amount measured in the rain-gauge at Greenlands (Right Hon. W. H. Smith) was 2·25 in., and at Rotherfield Greys (Rev. N. Pinder) about 2·40 in. Both these gauges were, however, 2 or 3 miles from Henley, where the rain had apparently not been quite so heavy, and one of them (Greenlands) was in a sheltered position, so that I am inclined to think that my estimate is not far from the mark. A good deal of damage was done, a wall washed down, houses flooded, roads cut up, &c. The Thames also rose considerably in the course of the night and overflowed its banks.—*Rogers Field.*

ADDINGTON, WINSLOW, BUCKS.—The most violent TS we have had for years in this district visited us last night; indeed, there were four distinct TSS—the first from 8.30 until about 10 p.m. The storm rose in the W. and seemed to have spent itself out in the E. by 10 o'clock. Another and more violent TS followed from the same direction before midnight, lasting a considerable time; the T one continual rumble with frequent very loud crashing peals; the L incessant, the whole country side lit up; most distant objects seen with great distinctness. R during the storm, 0·85.—*John Mathison.*

TETWORTH HALL, SANDY.—Total R during the TSS, 2·24 in.; much damage is done here.—*M. Kaye.*

FARM HALL, NEAR HUNTINGDON.—Very heavy TS between 2 and 3 a.m. Total R, 1·57 in.—*G. J. Bevan.*

BANK, BIGGLESWADE, BEDS.—During the severe TS which raged here last night I registered the exceptionally heavy rainfall of 2·36 in. A greater flood than has ever been known in this district has risen to-day.—*C. T. Newbery.*

ODSEY GRANGE, ROYSTON.—R in the TS of Saturday evening and Sunday morning, 1·81 in.—*H. George Fordham.*

GRANCHESTER MILL AND BEECH HOUSE, CAMBRIDGE.—The extraordinary storms of T, L and R of Saturday night and Sunday morning suggest a special notice. The first commenced about 10.30 p.m., and was over about 11 p.m., but at 1 a.m. another TS began, which lasted till 4.30 a.m., and the L and T were incessant. There were about 56 flashes every minute. I never saw anything like it. I do not think it was at any time quite over us, but four claps of T were remarkably loud and awful. I found to my surprise we had had 3·60 in. of R at Beech House. The largest quantity I have previously known in 24 hours in the 16 years I have observed, was 1·59 in. in three hours on June 17th, 1875. At Granchester Mill, about two miles distant, 3·92 in. fell. The fields are very much flooded, and there were two fires near—one at Fulbourn and another at Haslingfield. Two remarkable things attended these storms; one was the high state of the bar. being 30·10, and the other the low state of the thermometer, the highest having been only 66° the previous day.—*Jas. Nutter.*

(To be continued.)

STRATUS AND CIRRO-STRATUS.

To the Editor of the Meteorological Magazine.

SIR,—Mr. Dillworth Howard's letter contains one indictment, to which I at once plead guilty. Cloud observations are to me, as I think they should be to every meteorologist, principally valuable as giving us information on the subject of the atmospheric currents.

Still, a critic, if he quotes at all, should do so correctly. I did not "aver that the varying habitat of Cirro-stratus has made confusion worse confounded;" but that the application of the term Cirro-stratus by the older observers to some of our fogs does so. That application I regard as a misapplication.

However, the question between us is one of wider import than that of the correctness of a phrase in a lecture. "One thing," Mr. Howard writes, "is certain, that there is no better way to introduce confusion into a science than to take names already of universal application and pin to them new and widely different meanings." Is the study of the clouds, in its present condition, a "science" at all? Can it be formulated? Can it be by fixed rule methodized? Is it clearly capable of being communicated? Is it a progressive branch of knowledge, or has it in the last forty years made any distinct advance? I fear that to these questions we must reluctantly answer, No; And if any thing is to be done to clear the way for such a study to spring up into a science, our first endeavour will be to prune the obstructive growth of its vaguer phrases, and to give definitiveness and restriction to its terminology. But there is an alternative. If the effort fail, *e.g.*, with regard to the word "Cirro-stratus," it does not matter much. It is easy to foresee what will then occur. A word of such "universal application," that hardly any two observers are agreed as to its meaning, will be tacitly dropped by the meteorologist, and some other will take its place. Already I perceive that the half-English expression "Sheet-Cirrus" is, for this reason, beginning to do duty for the Latin "Cirro-stratus" in the restricted sense of the halo-forming canopy. And for a similar reason, a fog is called a fog, and is not called a "Stratus" by any but a few, and those mostly old-fashioned observers. "Cirrus" keeps its title, and is likely to do so; and why? Because that title represents a certain distinctly recognisable entity, and calls up a fixed idea. The same is true of "Cumulus." And we should wish the same to become true of our other old and favourite cloud names. But if they are too sacred to have their interpretation meddled with at all, we shall be driven to find others instead.

Cloud-lore is intimately connected with Wind-law. But the latter *is* a science, young indeed, yet robust and progressive. Must the union prove like that of Tithonus and Aurora, because "the gods themselves cannot recall their gifts;" because the Howards can permit neither modifications nor substitutes in the phraseology which

they have given us? Then will the "strong hours," unable to "end" the study of the cloud-forms, at least "leave it maimed, immortal age beside immortal youth," a study of beautiful objects, and full of the reminiscences of justly honoured names, but eminently non-progressive, because burdened with a terminology both inadequate and rigid.—Yours truly,

W. CLEMENT LEY.

Ashby Parva, Lutterworth, July 19th, 1879.

HAILSTONES—RELATION OF WEIGHT TO SIZE.

WE are not aware that any calculations or observations have been made as to the relation which exists between the dimensions of hailstones and their weight. It is evident that precise values cannot be given, because the density of hailstones varies with their nature: some are true spheres of crystalline ice, others are formed of alternate layers of clear and opaque ice, while others are chiefly opaque with but a thin crystalline coating.

Nothing but a long and troublesome series of observations can determine precisely the specific gravity of these various forms, but fortunately it is possible to determine their greatest weight—they cannot be heavier than if they were spheres of pure ice. A cubic inch of water weighs 253 grains, but the specific gravity of ice is 0·93, therefore a cubic inch of ice cannot weigh more than 235 grains, or a trifle over half an avoirdupois ounce.

The following table has been computed on the assumptions:—

(1) That the hailstones are truly spherical.
(2) That they consist wholly of clear ice.

Although the first condition is rarely fulfilled, the table is certainly useful as a check upon the random statements as to weight and size frequently made.

Although it is always desirable to obtain measures of size whenever practicable, it is also well to supplement them by determinations of the volume or weight. The best way to ascertain the former is to collect ten of the largest and place them in the measuring glass of the rain gauge (with a card laid on the top to check evaporation), and read off the amount when melted—

| Each 0·01 in. in the measuring jar of an 8 in. rain gauge contains 127 grains.
,, 0·01 in. ,, ,, a 5 in. ,, ,, 50 grains.

Consequently it is very easy to find the weight of each hailstone; *e.g.*, supposing that the ten yield water which in a 5 in. jar reads 0·13, then

$$10\overline{)650} \begin{matrix} 13 \\ 50 \end{matrix} = \text{total weight in grains.}$$

65 = average weight of each stone.

By the following table it will be seen that such a stone corresponds with a sphere of clear ice rather less than 1 inch in diameter.

Diameter.	Approximate Circumference.	Weight.	
		Grains.	Ounces Avoird.
inches.	inches.		under
$\frac{1}{4}$	$\frac{3}{4}$	2	$\frac{1}{4}$
$\frac{1}{2}$	$1\frac{1}{2}$	15	
$\frac{3}{4}$	$2\frac{1}{3}$	52	
1	3	122	$\frac{1}{2}$
$1\frac{1}{4}$	4	240	$\frac{3}{4}$
$1\frac{1}{2}$	$4\frac{3}{4}$	416	1
$1\frac{3}{4}$	$5\frac{1}{2}$	660	$1\frac{1}{2}$
2	$6\frac{1}{4}$	984	$2\frac{1}{4}$
$2\frac{1}{4}$	7	1400	$3\frac{1}{4}$
$2\frac{1}{2}$	8	1920	$4\frac{1}{2}$
$2\frac{3}{4}$	$8\frac{1}{2}$	2560	6
3	$9\frac{1}{2}$	3320	$7\frac{3}{4}$

RAINLESS WEEKS.

To the Editor of the Meteorological Magazine.

SIR,—Seeing a letter from you in the *Times* a short time since, as to the period that has elapsed since there has been a week without rain or snow at Camden Square, you may, perhaps, think the following statement worth notice in your Magazine.

It is now more than a year since there have been seven consecutive days here without R or S, to the extent of at least ·01 of an inch having been recorded; July 23rd, 1878, was the last of 14 consecutive days without R; in fact, excepting ·02 on the 9th of that month, no R had fallen since the 3rd, giving twenty dry days, the 9th only excepted; since that time, as I have said, no single week has escaped either R or S.

There have been, however, some dry periods in which the above has only just been true, thus—October, 1878, 11th to 20th inclusive, ten days, ·01 and ·02 on 15th and 16th only; December 8th to 14th, seven days, ·01 on 11th only; January 4th to 10th, seven days, ·01 on 7th only; January 19th to 31st, thirteen days, ·02 on 24th, ·01 on 25th, and ·01 on 30th only.

Since the beginning of February we have only once had *four* days consecutively without R, March 6th to 9th; and since the 4th of May, now just upon three months, we have not had *three* days consecutively fine.—I am, Sir, yours obediently,

J. W. SCOTT.

Muswell Hill, Hornsey, Middlesex, July 31st, 1879.

SUPPLEMENTARY TABLE OF RAINFALL IN JULY, 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	2·71	XI.	Port Madoc	6·00
,,	Littlehampton	2·99	,,	Douglas	..
,,	Dorking Abinger.....	4·05	XII.	Carsphairn	5·88
,,	Hastings, Manor House	3·29	,,	Melrose, Abbey Gate...	4·32
,,	Hailsham	3·89	XIV.	Douglas Newmains.....	4·94
,,	I. of W., St. Lawrence.	3·66	XV.	Islay, Gruinart School..	3·71
,,	Strathfield Turgiss	2·71	XVI.	St. Andrew's, Cambo...	4·05
III.	Great Missenden.....	5·06	,,	Aberfeldy H.R.S.	2·32
,,	Winslow, Addington ...	4·13	XVII.	Tomintoul.....	2·47
,,	Oxford, Magdalen Col...	3·68	,,	Keith H.R.S.	3·41
,,	Northampton	3·39	,,	Forres H.R.S.	3·40
,,	Cambridge, Merton Vil.	3·64	XVIII.	Strome Ferry H.R.S....	6·98
IV.	Harlow, Sheering	4·21	,,	Lochbroom	4·83
,,	Diss	5·44	,,	Auchnasheen H.R.S. ...	2·77
,,	Swaffham	5·37	,,	Tain, Springfield.....	4·95
,,	Hindringham	5·32	,,	Loch Shiel, Glenfinnan.	11·41
V.	Salisbury, Alderbury...	3·15	,,	Dalwhinnie H.R.S.....	...
,,	Calne, Compton Bassett	3·82	XIX.	Lairg H.R.S.	...
,,	Beaminster Vicarage ...	4·10	,,	Altnabreac H.R.S.	2·89
,,	Dartmoor Prison.....	8·68	,,	Watten H.R.S.	3·50
,,	Langtree Wick	3·70	XX.	Fermoy, Glenville	3·68
,,	Lynmouth, Glenthorne.	3·09	,,	Tralee, Godfrey Place...	3·86
,,	St. Austell, Cosgarne...	5·05	,,	Cahir, Tubrid	2·10
,,	Taunton	2·83	,,	Tipperary, Henry St....	3·20
VI.	Bristol, Ashleydown ...	3·88	,,	Newcastle West	3·63
,,	Wem, Sansaw Hall.....	3·82	,,	Kilrush	2·96
,,	Cheadle, The Heath Ho.	3·67	,,	Corofin	3·76
,,	Bickenhill Vicarage ...	3·87	XXI.	Kilkenny, Butler House	3·47
VII.	Melton Mowbray	4·25	,,	Ballymore, Eustace ...	...
,,	Horncastle, Bucknall...	3·51	,,	Kilsallaghan.....	4·55
VIII.	Walton-on-the-Hill.....	3·46	,,	Navan, Balrath	4·34
,,	Broughton-in-Furness..	8·76	,,	Athlone, Twyford	4·72
IX.	Wakefield, Stanley Vic.	3·26	,,	Mullingar, Belvedere...	4·14
,,	Ripon, Mickley	4·57	XXII.	Ballinasloe	3·71
X.	Gainford	3·39	,,	Clifden, Kylemore	6·76
,,	Haltwhistle, Unthank..	4·51	,,	Crossmolina, Enniscoe..	5·67
,,	Shap, Copy Hill	5·19	,,	Carrick-on-Shannon ...	5·59
XI.	Llanfrechfa Grange	4·47	,,	Dowra	5·76
,,	Llandovery	5·76	XXIII.	Rockcorry.....	5·32
,,	Solva	2·70	,,	Warrenpoint	5·68
,,	Castle Malgwyn	2·74	,,	Newtownards	5·89
,,	Rhayader, Nantgwillt..	7·88	,,	Larne, Carnlough	5·58
,,	Carno, Tybritle	6·09	,,	Bushmills	4·44
,,	Corwen, Rhug	5·13	,,	Buncrana, Rockfort ...	6·42

JULY, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	4·17	+ 2·38	·91	19	20	80·2	30	45·6	11	0	0
II.		Maidstone (Hunton Court)	2·72	+ 1·08	·47	2	14	...	...	...	...	...	...
,,		Selborne (The Wakes)	4·14	+ 1·94	·96	19	20	75·0	29	45·5	11	0	0
III.		Hitchen	3·78	+ 1·88	·62	13	20	73·0	30	45·0	5	0	0
,,		Banbury	3·78	+ 1·72	·63	20	20	75·0	29	44·0	6	0	0
IV.		Bury St. Edmunds (Culford)	5·09	+ 3·10	1·18	21	19	79·0	30	42·0	24	0	0
,,		Norwich (Cossey)	4·62	+ 2·65	1·37	21	18	80·0	30	42·0	19	0	0
V.		Bridport	3·96	+ 1·85	1·25	19	16	...	...	...	...	...	...
,,		Barnstaple	3·57	+ ·71	·82	19	24	80·0	30	...	...	...	...
,,		Bodmin	4·92	+ 1·81	1·05	16	27	76·0	29	50·0	11	0	0
VI.		Cirencester	3·77	+ 1·33	·72	19	19	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	3·69	+ 1·52	·76	13	20	75·0	29	44·0	26	0	0
,,		Tenbury (Orleton)	3·44	+ 1·06	·86	13	22	77·2	29	42·0	6	0	0
VII.		Leicester (Town Museum)	3·72	...	·75	13	23	75·6	29	46·5	11	0	0
,,		Boston	3·42	+ 1·12	·55	26	17	80·0	29	47·0	26‖	0	0
,,		Grimsby (Killingholme)	3·70	...	·64	21	18	75·0	28*	46·0	12	0	...
,,		Mansfield	3·27	...	·75	19	18	76·2	29	45·8	12	0	0
VIII.		Manchester (Ardwick)	...	...	...	...	...	...	...	...	...	...	...
IX.		York	2·87	+ ·93	1·00	18	13	...	...	...	...	...	...
,,		Skipton (Arncliffe)	8·14	+ 4·91	1·31	20	29	...	...	...	...	...	..
X.		North Shields	4·35	+ 2·54	1·00	21	23	70·7	28	46·5	16	0	0
,,		Borrowdale (Seathwaite)	13·60	+ 5·46	1·56	7	28	...	...	...	...	..	...
XI.	WALES.	Cardiff	4·00	...	·81	19	21	78·2	29	45·4	11	0	0
,,		Haverfordwest	3·19	— ·11	·70	20	21	74·5	29	46·4	10	0	0
,,		Lampeter (St. David's Coll.)	6·64	+ 3·09	·89	20	25	...	...	...	...	...	...
,,		Llandudno	3·33	+ 1·04	·64	1	19	74·4	29	50·0	2,11	0	0
XII.	SCOTLAND.	Cargen	4·14	+ 1·42	·68	13	22	71·4	22	45·2	11	0	0
,,		Hawick (Silverbut Hall)	4·89	...	·70	13	20	...	...	...	...	...	...
XIV.		Annanhill	3·90	...	·50	31	22	69·1	23	44·6	23	0	0
XVI.		Kilmory	6·86	...	·81	31	22	...	...	40·0	31	0	...
,,		Mull (Quinish)	7·54	...	1·52	1	20	...	...	...	...	...	..
,,		Loch Leven	4·10	+ 1·53	·60	2	17	...	...	...	...	...	...
,,		Loch Long (Arddaroch)	6·60	+ 2·18	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	5·67	+ 3·12	·82	31	18	71·0	29	45·0	11	0	...
,,		Braemar	2·96	+ ·68	·62	31	22	66·2	30	38·5	22	0	1
XVIII		Aberdeen	3·96	...	·86	31	26	70·7	28*	45·8	11	0	0
,,		Portree	6·11	+ ·04	1·93	2	19	...	...	...	...	...	...
,,		Inverness (Culloden)	3·90	+ 1·23	·86	21	11	70·5	29	40·0	16	0	0
XIX.		Dunrobin	5·13	+ 3·38	1·00	31	17	66·7	28†	43·0	11	0	...
,,		Sandwick	3·17	+ 1·28	·72	1	19	63·2	29	45·8	11	0	0
XX.	IRELAND.	Cork	...	...	...	...	...	...	...	...	...	...	...
,,		Caherciveen Darrynane Abbey	5·26	...	·71	27	28	...	...	...	...	...	...
,,		Waterford	...	...	...	...	...	...	...	...	...	...	...
,,		Killaloe	3·88	+ ·69	·40	19	23	80·0	18	41·0	11	0	...
XXI.		Portarlington	3·74	+ ·20	·50	19	28	72·0	28	45·0	26	0	..
,,		Monkstown, Dublin	3·51	+ 1·08	·47	12	22	...	...	...	...	...	...
XXII.		Galway	3·87	...	·49	7	23	66·0	15‡	44·0	11	0	...
XXIII		Waringstown	6·30	...	1·25	19	27	75·0	10	45·0	2	0	0
,,		Edenfel (Omagh)	6·78	...	1·31	1	26	68·0	18	44·0	23	0	0
,,		Ballinful	...	...	...	...	...	...	...	...	...	...	...

* And 29. † And 30. ‡ And 16. ‖ And 11, 12.

\+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON JULY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

SELBORNE.—Prevailing wind S. and S.W., occasionally N.W.

HITCHEN.—The coldest and most sunless July on record except 1875, harvest cannot commence until September, half the hay is still out and spoilt. Mean temp. 4° below the average of 30 years.

CULFORD.—A month of almost continuous rainfall, resulting in destructive floods, with, in some instances, the entire loss of the hay crop, and much injury to grain crops of all kinds. Harvest will necessarily be late, even rye showing no indication of changing colour yet, while in 1868 the entire harvest was completed by the last day of this month. Easterly winds prevailed during six days. Mean temp. 58°·2.

COSSEY.—A dull cold month, only six days on which the temperature reached 70 degrees.

BODMIN.—Mean temp of month 61°·2.

CIRENCESTER.—Another wet ungenial month, with a remarkable absence of sunshine, particularly in the early morning. The thermometer only rose to 80° once during the month.

SHIFNAL.—Rain fell daily with two exceptions till the 15th, and afterwards at intervals till the close. Hay crop heavy, but much of it badly housed. TS on 13th and 14th. Bar. very equable. Peas first gathered on 11th, strawberries on 13th, no butterflies, not even white.

ORLETON.—Cloudy, gloomy, and cold, with very little sun, R almost every day, and frequent gales of wind till the 23rd, when the sky became clearer and the air drier and warmer. On the 18th the ther. in shade reached 70°·8, which was the highest temp. registered since last autumn. Mean temp. nearly 4°·5 below the average, and below that of any July for more than 25 years past, the nearest approach to it being July, 1862, which was more than half a degree higher. TS on 14th, and distant T on 10th and 26th. The hay harvest was very late, and the wheat generally not in blossom till the last week of the month.

LEICESTER.—TS with H at 2.30 p.m. on 13th; T on 8th and 19th.

BOSTON.—Mean temp. of month 5° below the average, and the lowest recorded during the past 16 years. The max. in shade did not occur till the end of the month, and then only reached 80°, the min., however, (47°) has frequently been lower. The rainfall, 3·42 in., has frequently been exceeded, but the water in the Witham rose a foot higher than it has ever done in July during the last 30 years, but very little land is flooded. On the Welland the wash lands have been under water all the summer, and the hay and pasturage destroyed. Wheat first in ear about the 3rd, which is from three weeks to a month late, and the latest for 20 years, except 1860, when reaping did not begin till the 12th of September.

KILLINGHOLME.—Sunshine very deficient during the whole month, and no summer weather till quite the end. Everything very backward, and the barley on heavy land will not be half a crop. TS at noon on 9th.

WALES.

HAVERFORDWEST.—Although rain fell on 21 days, there were not more than three or four wet days, the fall taking place principally at night, which coupled with the heavy gales from W. and N.W. causing rapid evaporation, allowed a large per-centage of hay to be harvested in good condition. Mean temp. much below the average.

LLANDUDNO.—A variable month with deficient sunshine, and therefore most unfavourable for hay-making and ripening of fruits; mean temp. more than 1° below the average.

SCOTLAND.

CARGEN.—A dull gloomy month, with very little sunshine. Mean temp. 2°·5 below average. Vegetation has made little progress during the month; peaches, apples and pears will apparently be a complete failure. T and L at 4 p.m. on 9th.

HAWICK.—A cold, wet and sunless month, vegetation of all kinds fully a month behind. The dragon fly has never yet been seen, and the common black flies are so scarce that the swallows have been on short allowance for many weeks past; the grasshopper was seen and heard for the first time on the 16th.

ARBROATH.—The atmospheric pressure temperature and humidity throughout the month were altogether of an abnormal character, the outcome of which was the unusual rainfall of more than double the average of the last 37 years.

BRAEMAR.—Although the month has been dull, dark, damp, and cold, the crops with favourable weather would yet be very productive.

ABERDEEN.—A cold, wet ungenial month; only on six days did the temp. rise above 65°.

PORTREE.—A wet stormy month and extremely cold; fruit three weeks behind the usual time of ripening. Harvest will be very late here.

CULLODEN.—Bar. generally low during the month; temp. below the average. Fruit crop disappointing, all other crops promising, but suffering from want of heat and sunshine.

SANDWICK.—The rainfall was ·74 in. more that the average of the previous 38 years, and the month was colder than the mean till the 26th, from the prevalence of northerly and easterly winds; indeed W. wind has been rare, not only during the month, dut during all this year, and this, has no doubt, been the cause of our remarkably cold winter and summer.

IRELAND.

KILLALOE.—A very bad month for haymakers, only eight days without R. All crops from a month to five weeks late; potato blight appearing everywhere.

MONKSTOWN.—A dull, chilly, sunless month, with a large number of wet days, but no very heavy fall of R; T, L and H on 2nd. The only warm summer-like days were about the 18th.

WARINGSTOWN.—Unprecedently wet, but not so cold as preceding months. Crops in this district excellent, and except a few potatoe fields, as yet uninjured; turnips little grown here, but the crop will be deficient. Heavy thundershower at 3 p.m. on 26th, ·60 in. in 20 minutes.

EDENFEL.—Another month of excessive rain, low temperature, and absence of sunshine. Although 68° has been the highest temp. reached this year, the crops (being still in their growing stage) have suffered more from excessive moisture than from deficient heat. Grazing is extremely bad, as are also all green crops. Even should heat and drought now ensue, the harvest of cereals cannot take place till near the beginning of October. Altogether agricultural prospects have not been so bad since 1816.

RAINFALL IN THE N.W. OF ENGLAND.

To the Editor of the Meteorological Magazine.

SIR,—In an editorial note in your July number, p. 91, you state that there has been a great deficiency of rainfall in the north-western counties, and in the lake district, during the six months, January—June, 1879.

This remark certainly does not hold good for this part of Cheshire. I find that during these six months, the rainfall here has exceeded the average of the same months taken over the ten years 1869—1878, by 35 per cent.—Yours faithfully,

REGINALD BUSHELL.

Hinderton, Neston, Cheshire, August 5th, 1879.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLXIV.] SEPTEMBER, 1879. [PRICE FOURPENCE. or 5s. per ann. post free.

THE BRITISH ASSOCIATION AT SHEFFIELD.

THE days when the British Association drew its 3,000 and upward Members and Associates seem to have passed, or else we find it hard to understand the limited attendance at Sheffield, a centre of manufactures (which are really applied science), a town extremely accessible by rail, and where the local authorities, if they did not obtain success, deserved it.

During the twenty-five years, 1854 to 1878 inclusive, the average attendance was 2188; in 1879 it was only 1404, being the smallest during the whole period, with the exception of the meetings at Cheltenham, Cambridge, and Plymouth. We hope that in 1881 things will turn round, for it would be unreasonable to expect a large attendance at Swansea, where the meeting is to be held in 1880.

The following list of Meteorologists present at the meeting supports the general statistics quoted above; numerically, it is the shortest list we ever printed:—

Chadburn, A.	Sheffield.	Lowenthal-Lonsdale, Prof.	Bristol.
Clark, F. J.	Street.	Mackeson, H. B.	Hythe.
Dines, G.	Walton on Thames	Mello, Rev. J. M.	Chesterfield.
Dymond, E. E.	Apsley Guise.	Muirhead, Dr.	Cambuslang.
Elliot, R., F.R.S.E.	Wolfelee.	Osler, A. Follett, F.R.S.	Birmingham.
Evans, J., V.P.R.S.	Hemelhempstead	Palmer, H.	Sheffield.
Everett, Prof. J. D., F.R.S.	Belfast.	Pengelly, W., F.R.S.	Torquay.
Field, Rogers, C.E.	London.	Rawson, Sir R. W., K.C.M.G.	West Drayton.
Fordham, H. G.	Royston.	Rosse, Rt. Hon. Earl of, F.R.S.	Birr Castle.
Glaisher, J., F.R.S.	Blackheath.	Smith, B. Woodd	Hampstead.
Harrison, J. P.	Norwood.	Talmage, C. G.	Leyton.
Healey, G.	Windermere.	Taylor, T.	Aston Rowant.
Hopkinson, J.	Watford.	Verney, Capt., R.N.	Bangor.
Hughes, G. P.	Wooler.	Watson, W. H.	Braystones.
Jackson, M.	Ramsgate.		
Latham, Baldwin, C.E.	London.		

The number of meteorological papers was correspondingly small, the following being all that come within the scope of this magazine:—

Baldwin Latham—On the Temperature of Town Water Supplies.
Joseph Lucas—On the Quantitative Elements in Hydrogeology.
Professor Everett—Report of Committee on Underground Temperature.
Dr. M. Grabham—Report of Committee on Atmospheric Electricity.

James Glaisher, F.R.S.—Report of the Committee on Luminous Meteors.
Professor G. Forbes—On an Instrument for Determining the sensible warmth of the Air.
H. Courtenay Fox—On the Synchronism of Mean Temperature and Rainfall in the Climate of London.
Baldwin Latham—Experiments on the influence of the angle of the lip of Rain-gauges on the quantity of Water collected.
A. E. Fletcher—To exhibit an improved form of Anemometer.
J. Lowenthal-Lonsdale—On an improved Rain-gauge.
Professor J. D. Everett, F.R.S.—On some broad features of Underground Temperature.
E. J. Lowe, F.R.S.—Effects of the frosts of 1860-61 and 1878-79 on Vegetation.

REPORT OF THE COMMITTEE ON ATMOSPHERIC ELECTRICITY IN MADEIRA.

BY DR. M. GRABHAM.

Daily observations in Madeira are extremely monotonous, showing very little variation, though suggesting the importance of a station so uniform in weather for the careful observance of diurnal and seasonal changes. The writer, giving himself to the observation of the regular winds and breezes, traces the steady rise of electricity in the early morning to a maximum at 11.30 a.m., which declines, after much steadiness for two hours, at first suddenly and then very gradually towards night.

Remarkable fluctuations are noticed during the formation of the maximum, which the writer ascribes to masses of cloud on moist air. A description follows of the daily formation of a thin stratum of cloud during fine calm weather which varies slightly in altitude in accordance with temperature and barometric pressure. The electricity below this cloud is always positive and moderately strong. In the cloud itself it is more feeble but of the same sign. Above the cloud at the station where the observation was taken it was very feeble and irregular but always positive. In warmer weather the vapour does not condense into cloud but appears as a blue transparent haze from above, and presents the same electrical indications.

The writer states that all observations in his own garden were vitiated or mitigated by the presence of lofty trees.

The highest potential was observed upon a rock ninety feet high, a few metres from the shore in the Bay of Funchal.

The thinness of the currents of air constituting sea breezes was demonstrated by flying a kite vertically beyond into the true wind blowing in a contrary direction. Abortive attempts were made to bring down the upper electricity through the lower currents. The electricity of the general north-east wind, which is identical with the trade wind, was found on the heights at the east end to be uniformly moderate and positive.

At the approach of rain-clouds at the termination of a period of fine weather the atmosphere invariably gives increased readings and no negative observations were recorded.

A short description follows of the L'este, a kind of sirocco to which Madeira is occasionally subject, and which blows with great force on certain limited mountain districts bringing sand, birds, and other evidence of a distant origin. This wind is extremely dry, in a temperature of 85° the dew points being depressed below freezing. Electrically this wind in its integrity gives no indication of any change whatever except by faint fluctuations about the earth reading.

The writer also notices a very highly electrical condition during the prevalence of L'este wind, of certain clouds which lie quietly among the mountains, though tossed and tumbled on their upper surfaces; he hopes to be able to connect their forms and immobility with their electrical change.

ON AN IMPROVED RAIN GAUGE.

BY J. LOWENTHAL LONSDALE.

A self-recording rain gauge was exhibited by Professor Lowenthal-Lonsdale, which differs in many respects from any of the forms of instrument described

in *British Rainfall*, 1878. The record is obtained by means of a float and rod as in Bevan's gauge, but there is also an intermittent syphon for emptying the gauge when one inch of rain has fallen; as far as we know this is the only recording gauge in which these two principles are combined. The instrument has several advantages over existing forms, and many of the details are well arranged, but of these a full description, and also a sketch of the instrument, will be given in *British Rainfall*, 1879, so we reserve till then all further remarks on its merits.

REPORT OF THE COMMITTEE ON LUMINOUS METEORS.

By James Glaisher.

After recording the regret the Committee felt at the loss of two of the most active workers—Mr. Greg by his retirement, and Mr. Brooke by death—the report stated that the very unfavourable weather had generally caused only very meagre views of the annual star showers of October, December, January, and April to be obtained. The major showers of August had also been hidden from view, owing to the unfavourable weather. The report then dealt in detail with the accounts of conspicuous detonating fire-balls that had occurred in the United States on August 11 and December 18, 1878, and on January 27, 1879; in Bohemia and Saxony on January 12, 1879, and in England on February 22 and 24, 1879, the real paths of all of which had, to a greater or less degree of certainty and closeness, been approximately ascertained. The rest of the report was devoted to a description of the past year's aërolites. The expected return of Biela's comet to its perihelion in the present year, leading a shower of shooting stars to be looked for with much confidence among astronomers on November 27 next, is to be taken advantage of to report next year on meteor showers. As in former years the Committee were under great obligations to Prof. A. S. Herschel for the labour he had bestowed on the report.

EXPERIMENTS ON THE INFLUENCE OF THE ANGLE OF THE LIP OF RAIN GAUGES ON THE QUANTITY OF WATER COLLECTED.

By Baldwin Latham, M. Inst. C.E., F.G.S., F.M.S.

The author having observed that, in the ordinary pattern of the Glaisher gauge, in high winds the rain was often driven up the sloping lip and into the gauge, thought that if the rim of the gauge were made very acute, having a sharp knife edge and equal angles both inside and outside the gauge, any rain which might strike upon the outer angle on one side of the gauge might be thrown into the gauge. Rain striking upon the inner and opposite side of the gauge would be thrown out, and so an equilibrium rim would be constructed, as the gain on one side would be balanced by the loss on the other side.

With this view, the author had an 8-inch gauge made and tested alongside of an 8-inch Glaisher gauge. The sloping lip of the Glaisher gauge had an angle of 45° from the perpendicular, and the rim of the equilibrium gauge was ·80 in. deep, ·18 in. in thickness, sloping off on both sides at an angle of 3° from the perpendicular. Both gauges were fixed at Croydon, 4 feet above the ground, and 259 feet above Ordnance datum. These gauges had been working side by side for 551 days, from January 5, 1878, to July 5, 1879, during which period rain or snow has fallen upon 306 occasions. Upon 43 occasions it was found that the rain collected in the Glaisher gauge exceeded, by a small amount, the rain in the equilibrium rim-gauge, and on two occasions the quantity in the new gauge exceeded that in the Glaisher gauge. Upon 261 occasions the rain in both gauges was absolutely equal. On all occasions, it should be observed, the rain from both gauges was invariably measured in the same graduated measuring glass. On the 45 occasions when the Glaisher gauge collected most rain, the wind without exception was high. On the two occasions when the equilibrium rim-gauge collected more rain than the Glaisher gauge, it was probably due to dew, the equilibrium gauge presenting a larger surface for condensation than the other gauge. As the Glaisher gauge was not calculated to contain snow, all falls of snow are recorded in the equilibrium rim-gauge, which is constructed to hold about one foot in depth of snow.

The total quantity of rain collected in the Glaisher gauge during the period

of observation, plus the snow as caught in the equilibrium rim-gauge, was 46·68 in., and the quantity collected in the equilibrium rim-gauge was 46·45 in., showing a difference of but half per cent. In all probability, however, the small excess measured by the Glaisher gauge would tend to compensate for the losses by evaporation in periods of small rainfall and at other times, and therefore, as a measuring gauge, the Glaisher pattern of gauge, when tested by a gauge of the description mentioned, gives results in practice which may be taken as correct.

Summary of Results.

Date.	Total number of days' experiments.	Number of days when rain fell.	Amount of rain collected by Glaisher gauge.	Amount of rain collected by equilibrium rim-gauge.	Times when Glaisher gauge in excess of equilibrium rim-gauge.	Times when equilibrium rim-gauge in excess of Glaisher gauge.
1878.			inches.	inches.		
January	31	17	1·145	1·115	6	...
February	28	15	1·440	1·430	2	...
March	31	10	1·300	1·295	1	...
April	30	17	3·940	3·940	0	...
May	31	22	3·480	3·460	4	...
June	30	13	3·205	3·190	1	...
July	31	11	·595	·600	0	1
August	31	20	5·725	5·690	7	1
September	30	11	1·015	1·010	1	...
October	31	18	2·140	2·135	1	..
November	30	22	3·775	3·735	8	...
December	31	20	1·460	1·455	1	...
1879.						
January	31	13	2·610	2·610	0	...
February	28	22	3·380	3·360	4	...
March	31	13	·540	·540	0	...
April	30	19	2·535	2·515	4	...
May	31	18	3·600	3·595	1	...
June	30	20	3·690	3·680	2	...
July	5	5	1·105	1·095	2	..
Totals	551	306	46·680	46·450	45	2

ON SYNCHRONISM OF MEAN TEMPERATURE AND RAINFALL IN THE CLIMATE OF LONDON.

By H. Courtenay Fox, M.R.C.S.

The object of the paper is by the examination of a long series of facts to ascertain whether there be any law which regulates the *occurrence at the same time* of extremes of temperature and rainfall, so far as we can ascertain it in the English climate.

The facts used are the rainfall and mean temperature as for the Royal Observatory in each month and season for 66-67 years. The mean temperature from 1813 to 1840 is that computed by Mr. James Glaisher, F.R.S. (*vide Philosophical Transactions*, 1850, part 7); and from 1841 to the present time, it is from direct observation. The rainfall from 1830 to 1840 is derived from sundry observations about London collated by Mr. George Dines, and from 1841 to the present time it also is from direct observation at the Greenwich Observatory.

The author has constructed tables *for each month*, in which the sixty-seven (or sixty-six) years are arranged in the order of the mean temperature of that month, beginning with the coldest and ending with the warmest, and also arranged in like manner in the order of their amount of rain. The sixty-seven years are then divided, as nearly as can be, into five equal sections, of which the middle section is termed average years; the division on each side of the average are termed cold and warm, dry and rainy, respectively; while the extreme sections are qualified by the word *very*, being called very cold, very warm, very dry, and very rainy, respectively. We have thus a pretty fair division of the series of years in both these characters. What has been done for each month has been also done on exactly similar principles for each season and for the whole year. The results found were :—

1. In the winter months, cold tends to be synchronous with dryness, warmth with large rainfall.
2. In the summer months, cold tends to be accompanied by much rain, warmth by dryness.
3. Rainy years tend to be either very cold or very warm, whilst years of drought tend to assume an average temperature.

WHIRLWIND IN EAST YORKSHIRE.

"REMARKABLE PHENOMENON.—A few days ago a destructive whirlwind visited the neighbourhood of North Cave, resulting in considerable damage to property, and causing much alarm amongst the inhabitants of the locality. A farmer named John Johnson gives the following version of the affair :—About half-past seven in the evening he was in his house, when he heard a noise like that of prolonged thunder, or the rushing by of three or four railway trains. On going outside he saw a clearly-defined whirlwind, of, as he says, the "thickness of three or four stacks," moving in a north-easterly direction. It disappeared rapidly, but was found to have left fearful marks of its progress. On Mr. Johnson's farm six trees have been torn up and broken, one being an oak of from 50 to 60 years' growth, and about three to four feet in circumference. In some places the hedge was broken for a considerable distance, whilst in others the tops of the corn had been cut off as clean as if it had been done with a knife. In other places which the whirlwind passed over trees were stripped of their branches, and one old oak, four feet in diameter, was twisted so completely from the middle to the top that the upper part presented the appearance of being broken into shreds. The whirlwind spent itself near Sancton, but its track could be distinctly traced by the destruction it had caused."—*York Herald*, Aug. 30th.

THUNDER AND HAILSTORM OF AUGUST 2nd & 3rd.

(Continued from page 113.*)*

IN the first place, we have to express our regret at an accident. The following paragraph, which was in type, was in some mysterious way omitted in the narrative as printed off; it should follow the report from Kew Observatory on page 107 :—

KEW GARDENS.—All the houses were more or less damaged, most of them, especially the temperate house, so seriously that they were

closed to the public in order to avoid accidents from falling glass. The total cost of the repairs is expected to be £2,000.—*Ed.*

We have to thank many friends for a large supply of facts bearing upon the storms both of August 2nd and of August 16th; but we think that the best plan will be, merely to print a few typical reports respecting the former storm in continuation of the previous article, and to reserve all the rest of the data for incorporation with the reports of the whole body of rainfall observers in the volume of *British Rainfall* for 1879.

MERTON VILLA, CAMBRIDGE.—I send you a few notes on the violent TS of August 2nd (night). R fell between 10.15 and 10.45 p.m. (2nd), and from 1.30 a.m. to 4 a.m. (3rd), total 3·80 in. A little H at 3 a.m. L and T incessant from 1.30 to 3.30 a.m. At 3 a.m. there were 120 flashes of L per minute within a radius of 3 miles. At 3 a.m. a flash was instantaneously followed by a very explosive crash of T. The casualties from L were fires at many farms in the neighbourhood, and some few head of cattle were killed. Much damage was caused by the bursting of drains and overflowing of the river and brooks.—*Geo. Warren.*

OBSERVATORY, CAMBRIDGE.—Terrible TSS passed over Cambridge during the night of August 2nd and morning of the 3rd, the severity of which has not been equalled in Cambridge since the memorable hail storm of August 9th, 1843. The weather during the morning of the 2nd was pleasant, slight haze was noticed round the horizon, with a moderate breeze from E.; by 5 o'clock cumuli began to collect from the S.E., and the atmosphere became rather oppressive, and slight fears were entertained that a TS might occur, but towards 8 p.m. these clouds began to move and break up, and it was not till 9.45 p.m. that T was first heard, the wind then having become very strong; by 10 p.m. the violence of the storm was over us, the sky was illuminated for one hour with incessant flashes of sheet and forked L, whilst there was a continuous roar with the T, R, and wind; at 11 p.m. the moon began to break through the clouds, and hopes again were entertained that the worst was over; but at 1.45 a.m. another storm arose far more severe, lasting till 5 a.m., the R the whole time was alarming and the sky was blazing with incessant sheet and occasional forked L. The bar. and the wet and dry bulb thers. were nearly stationary throughout the interval, so that no warning could be obtained from their readings of the magnitude of the storm that was approaching. It was considered that the first storm came up from the S.W., being the upper strata, whilst a lower was moving from the E. The damage done in the flooding of houses and washing away of walls exceeds any remembered by the oldest inhabitant. The amount of R registered here was 3·18 in. by the 8 in., and 3·19 by the 5 in. gauge, being more than half an inch greater than in the storm of 1843. The college walks and the roads generally were washed into large holes or torn up. I enclose a set of readings before and after the storm.—*H. Todd.*

1879.	Time.	Barometer Readings corr. and reduced.	Dry Bulb.	Wet Bulb.	Max. & Min.	Direction of Wind.	Force.	Cloud.	
		in.	°	°	°				
Aug. 2	8 a.m.	30·172	58·5	55·0	75·0	N.	1	2	
,,	0.45 p.m.	30·144	70·0	60·0	50·0	E.	1	10	hazy cum.
,,	6 ,,	29·997	61·0	56·0		E.	1	10	do.
,,	9 ,,	29·997	60·0	57·0	...	E.	1	10	Cumulo stratus.
Aug. 3	8 a.m.	29·887	61·9	61·0	70·1	E.N.E.	1	10	Storm.
,,	10 ,,	29·878	65·0	63·0	52·0	E.	1	10	Stratus.
,,	11 ,,	29·846	66·0	64·0		E.S.E.	2	10	,,
,,	0 noon	29·866	67·0	65·0		S.E.	1	10	,,
,,	0.45 p.m.	29·866	67·2	65·0	...	S.E.	0·5	10	sultry.
,,	2 ,,	29·845	68·9	66·1	...	S.E.	0·5	10	nearly calm
,,	3 ,,	29·845	69·1	67.0	...	S.	calm	10	smoke from S.
,,	4 ,,	29·861	70·2	68·0	...	S.	,,	10	,, ,,
,,	6 ,,	29·858	71·0	69·5	...	S.W.	,,	10	,, ,,
,,	7.12 ,,	29·865	69·0	68·0	...	S.W.	0·5	10	very light breeze.
,,	9 ,,	29·874	68·0	67·0	...	S.W.	0·5	10	,, ,,
Aug. 4	8 a.m.	29·908	62·0	60·5	71·5 55·0	S.W.	1	7	fresh breeze.

WETHERDEN RECTORY, HAUGHLEY, SUFFOLK.—We had a most fearful storm of T, L, and R from about 2.30 a.m. till about 4.15 a.m. The whole atmosphere was kept alight by the L, the darkness being but momentary. The T followed several times immediately on a vivid flash, and came in fearful crashes and thuds. It seemed to go round from the S.E. to the N.W. One person says that it was not R that fell but a cloud bursting. The measure in the gauge was 1·77 in. A farmer, who has lived in the village for the last 40 years, remembers nothing like it. A brook, which runs through the village, rose to a level with the tables in the cottages, standing on the edge of it.—*C. J. Goodhart.*

GELDESTON, BECCLES.—Tremendous TS; between 3.30 a.m. and 5.30 a.m. 1·90 in. fell.—*E. T. Dowson.*

KIRKHAM, BABBACOMBE, TORQUAY.—The morning of the 2nd was threatening, with a falling bar., E.N.E. wind, and clouds coming from S.S.W. Distant T was first heard about 1 p.m., it increased at 1.33 p.m., when R began and continued till 3.27 p.m., when ·22 in. had fallen; vivid L and loud T occurred 3 miles to S.S.W. at 1.58, and T continued till 2.27 p.m. At 5 p.m. another storm came on, passing over us from 5.20 to 6 p.m., and going off to N.E., where T was heard till 6.30 p.m. Most of the flashes seemed to strike the earth, and were very vivid from 5.12 to 5.50 p.m., accompanied by loud T; the nearest flash was only a quarter of a mile off at 5.45 p.m., many of the flashes were forked. Slight R fell from 5.1 to 5.7 and 5.27 to 5.38, when it became heavier and continued till 6.15; it was excessively heavy from 5.50 to 5.55; in 3 min., from 5.51, ·18 in. fell, and in 1 min. (5.53–5.54) ·08 in. fell, being at the rate of 4·80 in. per hour. H ·03 in. in diameter, accompanied the R from 5.45 to 5.57 p.m. R from 5.38 to 6.15 p.m., ·41 in. Distant

T was heard occasionally from 7.3 to 7.48 p.m. At 9.12, L appeared in the S.W., accompanied by distant T till 9.20 p.m. The L then increased in frequency, and lasted till about 3 a.m. on the 3rd; it was very frequent, vivid, and accompanied by T after 10.20 p.m., especially from 11.25 p.m. to 0.17 a.m., when it reached its climax with a terrific flash, followed almost instantaneously by T like the discharge of a cannon close at hand. At 11.18 the flashes were 33 per minute, and continued at this rate for about an hour; they were of various colours, chiefly white, violet, and rose, and lighted up the landscape with the brightness of day. Showers fell after 9.40 p.m. (heavily from 0.5 to 0.16 a.m. on the 3rd) amounting to ·33 in. The total rainfall measured at 9 a.m. on the 3rd was 0·96 in. (in Torquay, at Lamorna, 1·06 in., and at Rocombe, 0·80 in.). The wind was generally E.N.E., strong from 5.45 to 10 p.m. on the 2nd; the storm clouds came from S.S.W., and the bar. oscillated considerably, but fell from 30·06 in. at 2 p.m., 2nd, to 29·84 in., at 0.35 a.m., 3rd. The temp. was about 58° during the storms. About half-past 5 p.m., a flash of L struck a chimney stack on a house at Tor, hurling part of it to the ground in a northerly direction, and going down the chimney the electric fluid forced the grate of a sitting room about 1 in. outwards and entered the room, but without injuring two ladies who were in it. I visited the house yesterday, saw the damage done, and was informed by one of the ladies that a small mass of fire remained "fizzing" on the fender for some seconds after the L entered the room. Not far from this an "aerolite" was reported to have struck a flagstaff and bounded on to the road, where it remained burning for some time; a similar occurrence took place on the lawn of Woodhill, St. Mary Church-road. A scaffolding pole attached to a house which was being built in the Babbacombe-road was struck, and a mason, working near, was stunned and had his trowel knocked out of his hand; at Paignton, the telegraph instruments at the post-office and railway-station were struck, and some farm buildings a few miles distant were set on fire by the L.—*Edwin E. Glyde.*

UPFIELD, STROUD.—A heavy TS passed over here at about half-past 7 p.m., passing off to the eastward; heavy T; R commenced at 4 p.m., but that appeared to follow the vale of the Severn. T and L occurred all the evening and at about midnight it appeared heaviest in the W. From about 1.30 a.m. till daylight it passed over us again, but from where it came or in what direction it was going it was impossible to tell. There were very few forked pieces, the lightning principally passing from cloud to cloud in ribbon form. Amount of rainfall from 4 p.m. Saturday till 9 a.m. Sunday, ·79 in.—*Rose E. Stanton.*

ASHBY MAGNA, LUTTERWORTH, LEICESTERSHIRE.—A very heavy TS passed over this place about 1 a.m.; T and L, with a deluge of R. I registered this morning 1.25 in., almost the whole of which fell in about two hours.—*E. Willes.*

THE WEATHER IN JULY AND AUGUST.

JULY.

During the first week of the month the same unsettled weather, which had prevailed for so long previously, was experienced. On the afternoon of the 30th June a brisk fall of the barometer began in the W., a large depression advanced over Ireland, and rainy weather with S.W. to S. gales, extended all over the Kingdom. On the 2nd July this depression was passing N., and strong W. winds or gales prevailed generally, with showers of rain and intervals of fine weather; but on the 3rd a small subsidiary disturbance advanced over the South of England, and continuous rain fell during the morning of that day. This subsidiary advanced eastward to Denmark during the night of the 3rd, becoming much deeper during its passage across the North Sea, while the main disturbance in the N. remained near the North of Scotland, and began to fill up. During the 4th and 5th the barometer rose everywhere, and the weather, though showery, was moderately fair on the whole.

There was little change in the general conditions of the weather during the succeeding week. Pressure was highest over the South-west of France, and depressions of varying magnitude passed from W. to E. across these islands. The winds varied according to the shifting positions of the different disturbances both in direction and force. Gales were experienced on the 7th, 8th, and 9th, and fresh to moderate breezes on the other days. The weather was generally dull and rainy.

There was no improvement in the weather during the third week. Depressions and their accompanying circulation of winds passed from W. to E. right across these islands, and though the breezes were generally light, rain was frequent and the sky was almost always overcast.

The last week of the month opened with very unsettled weather, a large depression passing from W. to E. across these islands, and causing strong cyclonic winds on the 20th, and gales on the 21st. As this disturbance passed off slowly to North Germany, the barometer rose, and fresh N. breezes, with cool cloudy weather, prevailed until the 23rd, when the barometer began to fall a little in the W., a S. breeze sprang up at Valentia, and the highest pressures were established over the Bay of Biscay. From this day to the close of the week the changes in the barometer were comparatively slight; an area of high readings lay over France and our south coast, with very slight barometrical oscillations, occasioning general variations in the amount of cloud, though the rainfall was comparatively small.

Of the remaining five days of July, the first four were for the most part fine, but the 31st was dull, close, and wet over England and Ireland, but fair in Scotland.

Temperature during the first three weeks was low for the season, but considerable improvement was shewn during the last few days of the month. Rainfall during the first week of the month was much above the average, and heavy falls were reported on the 14th, 20th, 21st and 24th.

AUGUST.

The first two days of the month were exceedingly fine and warm, but these happy conditions were soon cut short, and on the evening of the 2nd a decrease of pressure began in the West of France, and gradually extended northwards over these islands. The weather quickly became unsettled, squally, and showery, and continued so, with little change for the better, during the whole of the following week. During the first few days a depression passed very slowly across the Kingdom from the S.W., causing a very decided oscillation of pressure, and bringing with it rather strong breezes with a great quantity of rain, and cold weather for the season. On the 9th, the centre of the disturbance had reached Norway and was filling up, while a small anticyclone began to appear in the S.W., with fine weather and light winds.

The week succeeding was changeable, with great rainfall on some days, and low temperature generally. The first part of the week was fine and bright

over England, but dull in Ireland. A very gradual change took place, and by the 15th the weather had become unsettled in all parts of these islands. On the 16th, torrents of rain fell in many parts of the Kingdom, notably in the N.W., and the weather was most unpleasant. The wind was chiefly S.E. or S., but subsequently became very variable from W.

The weather during the next week was exceedingly unsettled, owing to the continued advance of depressions from the Atlantic. During the greater part of the time two areas of high pressure existed—one over Scandinavia and the other over the South of France—so that the disturbances moved in a N. or N.N.E. direction along our west coast, but on the 23rd the N. high pressure gave way, and the small depression, which then appeared in the Channel, passed across these islands almost due E. The winds were chiefly S.W., and though generally moderate in the N. and N.E,, frequently blew very hard in the S.W., and in the west part of the Channel. Temperature was rather low for time of year. Rain fell nearly every day, and at some places in Central and Southern England, the amount measured during the week was greatly in excess of the mean for the whole month.

Then, as to the remainder of the month, the same doleful tale of unsettled weather and low temperature must be told. The sea was rough on our W. and S.W. coasts during the whole period, and warnings were flying, on four days of the seven. During the night of the 25th–26th, a deep depression advanced over Scotland from the Atlantic, and in the course of the night following the centre of another deep depression reached the N.W. coast of Ireland, and passed, like the former, in a N.E. direction to Norway. The recovery, which had begun after these depressions had passed over, disappeared entirely during the night of the 27th–28th, and another disturbance approached and passed over, taking nearly the same course as the two preceding depressions. After this had passed away, the weather cleared up, and a little fine weather was experienced, the wind remaining, however, S.W. or W.

HORACE E. MILLER.

STRATUS AND CIRRO-STRATUS.

To the Editor of the Meteorological Magazine.

SIR,—My reply, to the Rev. Clement Ley's objection to my remarks as to the varying habitat of cirro-stratus as dealt with in his lecture, is on p. 112 of "Modern Meteorology." The quotation marks are correctly printed in my first letter, and not in his. I quite dissent from Mr. Ley's view that cloud knowledge cannot be easily communicated. I have better hopes of the future of the science. I do not think that future will be brighter if the present attempt to redistribute Howard's names succeeds. Far better to leave the foundation wall of the older observers alone; if sound, build on it; if unsound, leave it to time, and begin afresh.

WM. DILLWORTH HOWARD.

Tottenham.

RAINFALL IN THE N.W. OF ENGLAND.

To the Editor of the Meteorological Magazine.

DEAR SIR,—I have been interested in reading your letter of July 1st, in the *Times* of to-day, and in comparing your figures with the rainfall in this place.

You go back to the first half of 1878, in which you say the fall in London was enormous. I find ours was *less* by 0·34 in. than the average of the preceding six years, while the *total* rainfall for 1878

was only 44·92 in.—a very small one for us, being no less than 12·26 in. below the average of the preceding six years. The fall in November and December was, in fact, less than half the average.

Again, you say the rainfall in London for the first six months of the present year has been more than 50 per cent. above the average. I find ours to have been less than last year and 3·96 below the average of the preceding six years. The rainfall of each of the first five months was below the average, and had it not been for an exceptionally wet June, our fall for the first half of this year would have been remarkably small.

Now we are, of course, suffering, in common with the rest of the country, from excess of rain and absence of sunshine.

Rainfall for the first six months of 1879:—January, 2·08; February, 3·83; March, 3·56; April, 1·85; May, 1·94; June, 6·23; total, 19·49.—Yours truly,

G. F. BRAITHWAITE, JUN.

Hawesmead, Kendal, July 7th, 1879.

[We could not find room for this letter earlier; it should be read in connection with that by Mr. Reginald Bushell, on p. 120.—ED.]

NORTH WALES RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—The rainfall in August, 1879, was 9·93 in. Upwards of an inch fell on three days:—5th, 1·17; 16th, 3·75, 17th, 2·61. 6·36 fell almost without a break between noon on the 16th and midnight on the 17th. Between 5 p.m. on 16th and 5 p.m. on 17th, the estimated fall was 5·75. From the record of neighbouring gauges, and the effects of the flood, the centre of extreme downfall seems to lie between here and Caerwys.

In the last twelve years the extremes of monthly rainfall until the present return have been:—June, 1868, 0·00; October, 1872, 7·05. The annual rainfall here is nearly the least in Wales, the lowest of all being along the coast line of Flint and Denbigh.

I have been able to find no evidence of a greater flood having occurred during the present century in the vales of the Clwyd and Wheeler, whereas some of the effects of the present flood seem to point to the impossibility of a greater having occurred within the above period.

P. P. PENNANT.

Nantlys, St. Asaph, 5th Sept., 1879.

WATER REFLECTION RAINBOW.

To the Editor of the Meteorological Magazine.

SIR,—Can you find room in your September number for the following, which may interest your readers, from some of whom I hope to gain an explanation of what I saw?

On August 29th, at about 6.30 p.m., I was caught in a very heavy shower of rain on a hillside above Llanfairfechan; as it passed, a very brilliant rainbow developed itself, with the secondary bow fully

developed and bright, both (owing to the deep valley close on our left, and the height at which we stood) showing more than two-thirds of a circle. As we watched, a third bow gradually formed, not concentric with the other two. The prismatic colours were in their regular order, the lower limbs were both within those of the bow proper, the upper part of the curve was three or four degrees, at least, above that of the refracted bow. I am not sure of the shape of the curve; at the moment, we both thought it slightly elliptical, with the major axis perpendicular to the horizon, but I am not sure that our eyes were not misled by the intersecting segments of the brighter circles. Whatever it was, nearly the whole curve was developed, not more than one-sixth or one-seventh being lost against the ground.

Though much fainter than either of the other bows, it was quite distinct, and remained visible for two minutes or more. It was the first to fade.

Could this possibly be due to the reflection of the sun's rays, which we had noticed before to be very bright, from the sea, which lay 700 or 750 feet below us? If not, will you or some of your readers be kind enough to explain the phenomenon to

AN IGNORAMUS.

[Ignoramus is probably right in his explanation; a full account of the phenomenon, with several engravings, will be found in the *Meteorological Magazine*, for December, 1875, vol. x., p. 165.—ED.]

WIND FORCE.

To the Editor of the Meteorological Magazine.

SIR,—At p. 75 of the *Meteorological Magazine* for June you draw attention to the definitions of wind force, taken by M. Mascart, from the movement of branches of trees.

Might not this be put in a more definite form relatively to the power of movement, which varies much in trees of different species.

During the present year, testing my observations by the returns from Kew (which is under a mile-and-a-half distant as the crow flies), I find any real movement of the upper extremities of the leafed boughs of elm trees, stands as "1," Beaufort notation; movement of all the lesser boughs, so as slightly to stir the primary boughs near their junction with the tree, at "3;" and such movement of the boughs as slightly moved the trunks of the large trees (which I only saw once) stood at "7" or thereabouts.

The birch moves its leaves and long sprays, at "0."

The lime comes between the birch and elm in power of movement, at all small readings; and old trees of Scotch fir, from the peculiar tops of the boughs, in high wind would give a very easily noted amount of definition.

Trusting you will excuse me, if I only intrude on your time, believe me, yours very truly,

ELEANOR A. ORMEROD.

Dunster Lodge, Spring Grove, Isleworth, June 19th, 1879.

SUPPLEMENTARY TABLE OF RAINFALL IN AUG., 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	4·77	XI.	Port Madoc	6·81
,,	Littlehampton	5·41	,,	Douglas	6·28
,,	Dorking, Abinger	5·32	XII.	Carsphairn	7·41
,,	Hastings, Manor House	3·65	,,	Melrose, Abbey Gate	3·63
,,	Hailsham	4·61	XIV.	Douglas Cas., Newmains	4·09
,,	I. of W., St. Lawrence.	5·59	XV.	Islay, Gruinart School..	...
,,	Strathfield Turgiss	7·07	XVI.	St. Andrew's, Cambo...	...
III.	Great Missenden	7·44	,,	Aberfeldy H.R.S.	5·27
,,	Winslow, Addington	4·54	XVII.	Tomintoul	4·33
,,	Oxford, Magdalen Col...	5·05	,,	Keith H.R.S.	5·11
,,	Northampton	3·58	,,	Forres H.R.S.	4·30
,,	Cambridge, Merton Vil.	6·60	XVIII.	Strome Ferry H.R.S....	5·14
IV.	Harlow, Sheering	3·05	,,	Lochbroom	4·71
,,	Diss	4·69	,,	Auchnasheen H.R.S. ...	3·67
,,	Swaffham	5·81	,,	Tain, Springfield	3·83
,,	Hindringham	2·68	,,	Loch Shiel, Glenfinnan.	6·40
V.	Salisbury, Alderbury...	5·32	,,	Dalwhinnie H.R.S.	...
,,	Calne, Compton Bassett	6·81	XIX.	Lairg H.R.S.	3·67
,,	Beaminster Vicarage ...	5·75	,,	Altnabreac H.R.S.	4·35
,,	Dartmoor Prison	...	,,	Watten H.R.S.	4·28
,,	Langtree Wick	7·22	XX.	Fermoy, Glenville	3·93
,,	Lynmouth, Glenthorne.	5·65	,,	Tralee, Godfrey Place...	...
,,	St. Austell, Cosgarne...	6·40	,,	Cahir, Tubrid	4·44
,,	Taunton	4·63	,,	Tipperary, Henry St....	5·22
VI.	Bristol, Ashleydown ...	7·46	,,	Newcastle West	5·97
,,	Wem, Sansaw Hall	6·20	,,	Kilrush	4·38
,,	Cheadle, The Heath Ho.	7·26	,,	Corofin	4·53
,,	Bickenhill Vicarage ...	5·59	XXI.	Kilkenny, Butler House	4·00
VII.	Melton Mowbray	3·67	,,	Carlow, Browne's Hill..	3·81
,,	Horncastle, Bucknall...	3·18	,,	Kilsallaghan	3·12
VIII.	Walton-on-the-Hill	6·54	,,	Navan, Balrath	3·03
,,	Broughton-in-Furness ..	7·29	,,	Athlone, Twyford	5·15
IX.	Wakefield, Stanley Vic.	2·91	,,	Mullingar, Belvedere...	3·55
,,	Ripon, Mickley	3·71	XXII.	Ballinasloe	4·36
X.	Gainford	3·02	,,	Clifden, Kylemore	7·70
,,	Haltwhistle, Unthank..	4·54	,,	Crossmolina, Enniscoe..	6·81
,,	Shap, Copy Hill	5·66	,,	Carrick-on-Shannon ...	3·47
XI.	Llanfrechfa Grange	8·33	,,	Dowra	4·07
,,	Llandovery	7·18	XXIII.	Rockcorry	3·36
,,	Solva	5·81	,,	Warrenpoint	4·05
,,	Castle Malgwyn	6·78	,,	Newtownards	4·22
,,	Rhayader, Nantgwillt..	8·16	,,	Larne, Carnlough	4·18
,,	Carno, Tybritle	8·14	,,	Bushmills	2·60
,,	Corwen, Rhug	6·00	,,	Buncrana, Rockfort ...	2·88

AUGUST, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	5·11	+ 2·47	·82	19	16	78·3	15	44·8	31	0	0
II.		Maidstone (Hunton Court)	3·43	+ 1·23	·75	19	17	...	...	...	...	...	...
,,		Selborne (The Wakes)	6·45	+ 3·27	1·39	19	22	79·0	12	43·0	10	0	0
III.		Hitchen	4·61	+ 2·26	1·94	2	18	71·0	11*	37·0	31	0	...
,,		Banbury	4·31	+ 2·18	·97	17	19	76·0	12	42·0	30	0	...
IV.		Bury St. Edmunds (Culford)	4·12	+ 1·68	1·53	2	18	75·0	15†	34·0	31	0	1
,,		Norwich (Cossey)	5·08	+ 3·18	2·15	2	19	73·5	13	44·0	10	0	0
V.		Bridport	5·63	+ 3·04	1·58	19	18	...	...	...	...	...	...
,,		Barnstaple	5·52	+ 1·33	·86	19	21	79·0	16	45·0	24	0	0
,,		Bodmin	5·88	+ 2·02	·99	19	25	75·0	14	51·0	30	0	0
VI.		Cirencester	7·23	+ 4·39	1·20	16	17	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	6·16	+ 3·29	1·36	17	18	74·0	11‡	39·5	19	0	...
,,		Tenbury (Orleton)	6·21	+ 3·33	1·88	16	21	77·7	12	43·3	2	0	0
VII.		Leicester (Town Museum)	4·01	...	1·18	2	19	75·2	12	43·5	8	0	0
,,		Boston	2·88	+ ·59	·86	2	17	80·0	11	44·4	10	0	0
,,		Grimsby (Killingholme)	2·83	...	·66	2	19	70·0	21‖	46·0	9	0	0
,,		Mansfield	3·39	...	·80	2	21	73·7	12	43·2	10	0	0
VIII.		Manchester (Ardwick)	5·62	+ 2·11	·92	6	22	77·0	12	48·0	31	0	0
IX.		York	2·15	— ·56	...	...	20	75·0	12¶	42·0	10††	0	0
,,		Skipton (Arncliffe)	9·12	+ 3·18	1·08	28	22	75·0	13	38·0	31	0	..
X.		North Shields	3·42	+ ·57	·84	16	21	66·0	11	45·0	9	0	0
,,		Borrowdale (Seathwaite)	12·99	— 2·09	2·13	6	23	...	...	...	...	..	...
XI.	WALES.	Cardiff	8·12	...	1·34	27	22	72·4	15	46·2	30	0	...
,,		Haverfordwest	7·59	+ 2·71	1·83	4	22	74·0	12§	37·0	31	0	0
,,		Lampeter (St. David's Coll.)	...	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	6·85	+ 3·03	1·91	16	15	75·2	12	47·3	10	0	0
XII.	SCOTLAND.	Cargen	4·20	+ 0·01	·86	5	20	76·2	12	40·8	10	0	0
,,		Hawick (Silverbut Hall)	3·58	...	·61	5	20	...	...	...	...	...	...
XIV.		Annanhill	4·62	...	1·57	5	21	70·9	13	38·9	10	0	0
XVI.		Kilmory	5·28	...	·92	24	24	...	...	34·0	10	...	...
,,		Mull (Quinish)	5·16	...	·78	28	22	...	...	...	...	...	..
,,		Loch Leven	4·80	+ 1·12	·70	25	17	...	...	...	...	...	...
,,		Loch Long (Arddaroch)	...	...	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	4·15	+ ·92	·85	5	20	69·0	2	42·0	10	0	0
,,		Braemar	4·15	+ ·31	·58	25	21	73·8	12	35·3	3	0	1
XVIII		Aberdeen	4·33	...	1·13	16	25	72·3	14	43·4	30	0	0
,,		Portree	...	...	...	...	...	...	...	...	...	...	...
,,		Inverness (Culloden)	3·39	+ ·14	·65	7	13	74·0	12	40·5	3	0	0
XIX.		Dunrobin	3·47	+ 1·01	·78	16	19	70·8	12	40·0	30	0	0
,,		Sandwick	3·39	— ·32	·65	5	22	65·8	12	41·9	1	0	0
XX.	IRELAND.	Cork	2·11	...	·70	27	15	...	...	...	...	...	...
,,		Caherciveen Darrynane Abbey	4·87	...	1·42	26	24	...	...	...	...	...	...
,,		Waterford	4·60	+ ·65	·94	27	18	71·0	12	41·0	30	0	0
,,		Killaloe	4·76	— ·17	·69	15	19	81·0	23	40·0	31	0	...
XXI.		Portarlington	2·85	— 1·65	·58	25	25	72·0	10	41·0	29	0	0
,,		Monkstown, Dublin	3·23	+ ·02	1·17	5	18	...	...	...	...	...	...
XXII.		Galway	6·47	...	1·14	25	22	71·0	11‡	42·0	2	0	0
XXIII		Waringstown	3·59	...	·57	26	21	78·0	11	39·0	31	0	...
,,		Edenfel (Omagh)	2·68	...	·64	26	25	77·0	11	35·0	31	0	...
,,		Ballinful	...	...	...	...	...	...	...	...	...	...	...

* And 15. † And 17. ‡ And 12. ‖ And 22. ¶ And 13, 15. § And 13. †† And 11.
+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON AUGUST.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

SELBORNE.—Prevailing winds S.W. to W. T on six days.

HITCHEN.—A wet cold month; temp. 2° below average of 30 years, during which period there have only been three Augusts with a lower mean temp.

BANBURY.—The storm of the 2nd, which was very severe, commenced a little after 8 p.m. with L of a purple colour, and very frequently accompanied by rattling T. After 10 p.m. the L was distant but still almost continuous, and about 3 a.m. (3rd) it again came on in full force with H, but the latter was not remarkable. Some trees and a building or two in this neighbourhood were struck, and some calves huddled together under a tree were killed. No sign of commencement of harvest. Wheat looks tolerably well, but will not bear close examination. Barley and oats very short in the straw. Potatoes much diseased.

CULFORD.—A month of very unsettled weather, exceedingly unfavourable for harvest operations, which are more than a month late. The T and hailstorm of the 2nd and 3rd was most terrific; the T was one continuous roar, and the hailstones were a tremendous size, some of them measuring 5 inches in circumference; upwards of a thousand panes of glass were broken here, and in many instances two or more ice bullets have passed through a single pane without smashing it. Mean temp. 59°·6, considerably below the average.

COSSEY.—The nights were cold and the crops matured slowly. Harvest commenced here on the 29th, eight days later than in 1860. During the height of the storm on the morning of the 3rd the sheet L came in regular waves, with forked L every few seconds followed by loud peals of T. No such storm has been known here since 1843.

BODMIN.—Mean temp. of the month 62°·4, which is very nearly the average; but there is no record of another August with so little sunshine.

CIRENCESTER.—Another month of excessive rainfall, making a total of nearly 16 inches for the months of June, July, and August.

SHIFNAL.—The wettest August for at least 35 years, the nearest to it being 1852, when 5·94 in. fell. 2·50 in. of the fall of the 16th and 17th fell in 24 hours, from 6 p.m. on 16th to 5 p.m. on 17th. TS with violent wind on night of 2nd, and another with R and H on 21st. Gooseberry bushes stripped by caterpillars. Tomatoes on wall do not even blossom. A humming bird sphinx seen on 5th. Painted lady butterflies appeared on 14th.

LEICESTER.—TSS 8.30 to 10 p.m. and 1 to 2 a.m. on night of 2nd-3rd, and 11 a.m. to 0.30 p.m. on 13th.

KILLINGHOLME.—A cold month; no harvest work begun beyond cutting some worthless crops of peas. Apples, pears, and plums a failure; currants, gooseberries, and raspberries abundant. T, L and R, 2 to 5 a.m. on 3rd; T and L on 17th and 26th.

ARNCLIFFE.—Much hay still unhoused at the end of the month. TS at 4 p.m. on 17th.

NORTH SHIELDS.—TSS on 22nd and 26th; T on 3rd, 5th, and 6th.

SEATHWAITE.—Incessant R on the 4th, 5th, and 6th; total 4·20 in.; five days on which the fall exceeded 1 in.

WALES.

HAVERFORDWEST.—The temp. of the month was higher than that of the two preceding, but harvest prospects are bad; wheat and barley will not be half a crop, but oats will be fairly good, if the weather is favourable. On the whole this county has fared better than many districts, comparatively little hay being lost. No TSS except a very severe one on the 2nd, but severe gales and squalls with heavy R, especially during the last week. The rainfall (7·59 in.) has only twice been exceeded during 31 years.

LLANDUDNO.—The weather during the month was variable and showery, with occasional very fine days. Mean temp. more than 2°·5 below the average,

and rainfall nearly double. An unprecedented fall of R occurred between 2 p.m. of the 16th, and 7 p.m. of the 17th (a period of 29 hours), amounting to 3·67 in. Health of the community excellent.

SCOTLAND.

CARGEN.—Mean temp. of month 58°·5, nearly half a degree below the average. T on 3rd, 13th and 18th; L on 13th and 21st.

HAWICK.—A very wet and sunless month. Oats and barley are only just beginning to colour, and the hay is not yet all secured. Apples and pears will not ripen this season, and there are no plums. Potato disease very bad, and spreading rapidly. Severe TS on 6th, when ·50 in. of R fell in fifteen minutes. Swifts were never before seen in such great numbers, but most of them disappeared on the 15th.

BRAEMAR.—A month of changeable, damp, cold weather.

CULLODEN.—Temperature generally below the average. Bar. low, only twice rising above 30 in. All grain crops late; fairly good, but much in want of sunshine. Potato blight prevailing, and spreading in northern districts. All garden produce indifferent.

SANDWICK.—The weather was changeable, with frequent showers; not very warm, but not unfavourable to vegetation. Four peals of T on the 22nd, with some R, but the T was more frequent, and the R very heavy a few miles farther east.

IRELAND.

DARRYNANE.—A cold, ungenial month. Potato disease spreading much. Harvest very backward. The fall of 1·42 in. of R on the 26th occurred in 11½ hours.

KILLALOE.—No grain reaped at end of month, nor will reaping be general before the 20th of September. Hay being carried with difficulty, and much in bad condition. Potatoes much diseased.

WARINGSTOWN.—Temperature low; potato crop damaged; grain crops wonderfully little injured as yet. Commenced reaping oats Sept. 1st. T and L on 3rd. Tremendous TS at night on 11th. Heavy gale on 27th, 28th and 29th.

EDENFEL.—The weather of the month was reasonably favourable, but not sufficiently so to make up for that of the preceding months. Total rainfall moderate, though it fell on 25 days. One hot day (the 11th), and several warm ones; but sharp, though partial, frosts on the nights of the 9th and 31st. In this neighbourhood a large crop of hay has been fairly saved. Cereals are a heavy crop, but still green. Green crops, though still bad, are much improved, especially potatoes.

A STRANGE STORY.

"EXTRAORDINARY PHENOMENON IN FIFESHIRE.—A discovery, startling and unusual, was made on Sunday on the Lomond Hills, near Falkland, which has since given rise to considerable speculation. The hills were found in several places to be covered with seaweed, or some substance as nearly resembling it as possible, and it was also seen hanging from the trees and shrubberies in the district. In some places the weed lay in a pretty thick coating, so that quantities of it could be collected from the grass. A heavy hailstorm, accompanied by T and L, passed over the district on Saturday evening (Aug. 30th), and it is thought that at a late hour a waterspout had burst over the hills. Many people have collected pieces of the weed for preservation."—*Glasgow Herald.* [We should be glad of full details of this strange story.]—ED.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLXV.] OCTOBER, 1879. [PRICE FOURPENCE. *or 5s. per ann. post free.*

THE RAINFALL OF THE CHANNEL ISLANDS.

THANKS to the liberality and kindness of Prof. Raulin, of Bordeaux, we have the pleasure of issuing with the present number of this Magazine copies of that part of Prof. Raulin's great work which contains the details of the rainfall in the Channel Islands.

We have on several occasions drawn attention to the task which Prof. Raulin has undertaken, and which we rejoice to see approaching completion. Our readers have now, in the appendix issued herewith, the opportunity of judging how great has been the labour of compiling similar details for the whole of France, and what a mass of information is contained in the volumes already published. No human work is perfect, and we are not going to assert that Prof. Raulin has collected every rainfall observation ever made in France, but he has tried hard to do so, and with such success that we could hardly imagine a more hopeless task than to be instructed to compile a table of French rain records not quoted by Prof. Raulin.

We believe that a similar publication ought to be prepared in every country, so as to concentrate all existing data, and to avoid for the future the terribly wide search which is necessary in the past. At the present time, and we trust for all time to come, there has been established in most countries some central office, which charges itself with the annual collection and publication of all the rainfall observations made during the previous year. But until lately this was not the case; and those who undertake a task analogous to that which Prof. Raulin has nearly completed, must search, not only standard works, like Cotte's *Mémoires* or Martin's *Patria*, but long series of medical and engineering journals, and even of ordinary newspapers —the difficulty, indeed, is not so much where to search as where not to search, so strange and unexpected are many of the publications in which the observers of the last and of the first half of the present century published their records.

Besides the difficulty of collecting the data there is another, that of paying for the printing. This is no difficulty where the charge can be thrown on the nation, but it is almost prohibitory in other cases.

Regarding the accompanying extract, we need say little. Its utility is such as to need no praise from us.

Perhaps it may be well to tabulate the mean values for the various stations :—

		Mm.	Inches.
Alderney, Harbour Works ...	1851–71	725·2	28·55
Guernsey, Fort George	1854–70	729·9	28·74
,, York Place	1843–70	904·8	35·63
,, Grange Road.....	1866–70	931·1	36·65
Sark, Parsonage	1865–70	747·7	29·44
Jersey	1848–56	804·9	31·69
,, Millbrook	1858–70	745·3	29·33
,, Fort Regent	1866–70	711·0	27·99

For the convenience of those not familiar with the metric scale we give the following little table, which will enable anyone to convert any of the quantities into English inches. We have throughout ignored the decimals of a millimetre, as even **0·9** is less then 0·04 of an inch.

In one respect the table which we have given is in an unusual form. The usual way of reading the table would be to consider that it showed that **11** millimetres = ·39, **12** = ·78, and so on; but that is not the case : the numbers along the top are the multiples of those in front, and therefore we see that **10** millimetres = ·39, **20** = ·78, and so on. With this explanation and the series of examples from page 619, we cannot deem further remarks necessary.

	1	2	3	4	5	6	7	8	9	10
1	·04	·08	·12	·16	·20	·24	·28	·31	·35	·39
10	·39	·79	1·18	1·57	1·97	2·36	2·76	3·15	3·54	3·94
100	3·94	7·87	11·81	15·75	19·69	23·62	27·56	31·50	35·43	39·37

	Year.	Winter.	Spring.	Summer.	Autumn.
1860...	**1000** = 39·37	**300** = 11·81	**200** = 7·87	**200** = 7·87	**200** = 7·87
				60 = 2·36	**60** = 2·36
	40 = 1·57	**3** = ·12	**6** = ·24	**9** = ·35	**2** = ·08
	1040 = 40·94	**303** = 11·93	**206** = 8·11	**269** = 10·58	**262** = 10·31

PARHELIA.

To the Editor of the Meteorological Magazine.

SIR,—An exceeding perfect instance of the phenomenon known as "Parhelia" occurred here this morning, a description of which may prove interesting to some of your readers.

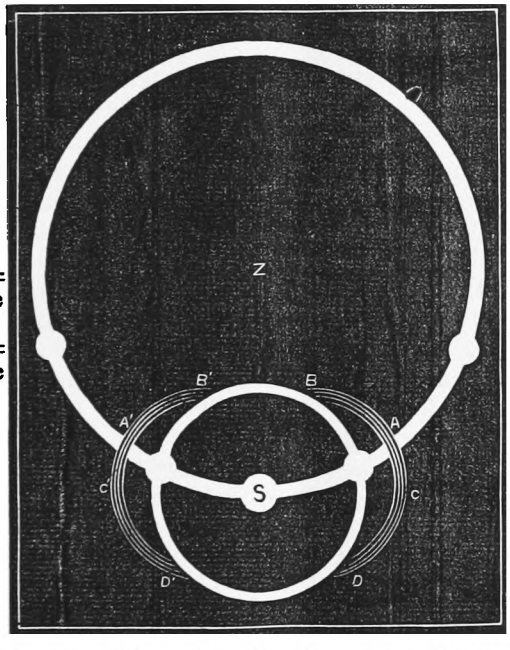
About 9.45 I noticed from the train on my way to business, a small piece of rainbow near the southern horizon, what sailors call a "weather-gall." A second glance showed me that this formed a portion of the halo of a pair of parhelia, in connection with which there appeared to be three intersecting circles, the exact relations of which I was unable to ascertain till I reached town and entered the grounds of Trinity College, where I had a tolerably clear view.

Round the sun was a complete and well-defined circle of light, some 30° in diameter, the sun being in the centre. Intersecting this was a second much larger circle, also complete, having the zenith for its centre, and the sun's zenith distance for radius, thus of course passing through the sun. At the two points of intersection of these

circles were brilliant parhelia, while on the large circle, and at some distance from the smaller one, on each side were two smaller parhelia, much less brilliant than the principal pair. Over each of these latter was a bow of light, as though an ellipse had intersected the smaller circle, the transverse diameter of which was about that of the circle. These bows were strongly tinged with prismatic colours, especially where they approached the circle, one of them being the "weather-gall" already alluded to. The upper end of each bow was much more brilliantly coloured than the lower.

Towards 10.15 these appearances gradually faded, but did not wholly disappear for a couple of hours. The sky was covered with what seemed a thin grey haze, with a few woolly-looking cumulus clouds near the horizon. The barometer was high—over 30 inches—and the wind was light and westerly; the temperature was considerably colder than yesterday, some 6° or 7°, say about 50°.

Z = Zenith;
A B and A′ B′ = strong prismatic arcs;
C D and C′ D′ = fainter prismatic arcs.



The enclosed sketch will explain the above description.—Faithfully yours,

GREENWOOD PIM, M.A., F.L.S.

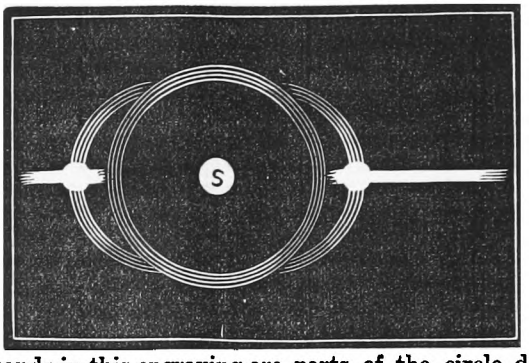
Monkstown, Co. Dublin, 22nd Sept., 1879.

To the Editor of the Meteorological Magazine.

SIR,—Yesterday I saw a remarkable halo and parhelia, of which I can find no example in any of the meteorological magazines, or in Herschell's or Buchan's meteorological works.

It was formed in cirrus clouds coming from the W., the surface

wind being also from the same direction. The following sketch will give some idea of its appearance from 0.45 to 1 p.m. :—



[The white bands in this engraving are parts of the circle described round the zenith in the other sketches.—ED.]

The remarkable part of the phenomenon was the supplementary arc on either side of the main halo, describing the section of a circle of which the sun could not have been the centre. The supplementary arcs were prismatically coloured like the halo, and having the red on the inside. An ordinary halo was visible all the morning, and a parhelion on its W. side from 9.50 to 11.30 a.m., and also on the E. side at 10.40 a.m., both being situated on the circle of the halo, as usually happens. The parhelia from 0·45 to 1 p.m. were situated on the supplementary arcs, as shown in sketch. The halos, &c., were occasionally obscured by passing cumuli.

At 2 p.m. the barometer (corrected to 32° sea level), read 29·975 in.; the dry bulb thermo. 59°·8, wet bulb 52°·6; and the wind was W., force 3. Last night it blew freshly from S.W., with rain, and this afternoon it is again raining.—Yours sincerely,

EDWIN E. GLYDE.

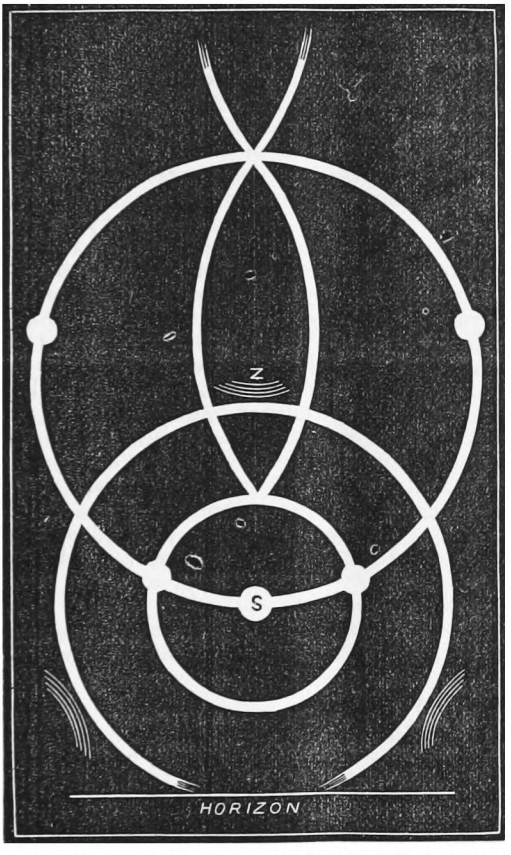
Kirkham, Babbacombe, Torquay, Sept. 23rd, 1879.

To the Editor of the Meteorological Magazine.

SIR,—I send you a copy of an article I wrote for the *Dublin Daily Express* and *Freeman's Journal*, on the wonderful display of halos and parhelia last Monday morning, and also a sketch of the phenomenon :—

"Between 9 and 10 a.m. of Monday, September 22nd, 1879, an unusually striking and beautiful display of solar halos and parhelia, or 'mock suns,' was seen from Dublin and its vicinity. The morning was bright and cold—'a morning without clouds'—but shortly before 9 a.m. a thin veil of cirrus cloud, floating at a great height, began to overspread the sky from W.N.W. When this cloud approached the sun a series of beautiful circles—some coloured like the rainbow, others of pure white light—became developed, and at certain points the brilliancy caused by the intersection of some of these circles gave rise to the phenomenon of parhelia, or 'mock suns.' At 9.40, when the display was seen in its greatest magnificence, two almost perfect circles were observed surrounding the sun—one at a distance of 22°, the other at a distance of 46° from the sun, as the common centre. To right and left, at a distance of 22° from, and at the same height above, the horizon as the sun, were well-marked parhelia, or 'mock suns.' But this was only half of

the display. The central circles were tipped at the points where the mock suns were situated by other and much wider circles which, with the zenith as their common centre, ran parallel to the horizon. One only of these was perfect, and it resembled a band or girdle of beautiful white light, running round the sky at the same height as the sun. Far beneath the sun to right and left portions of rainbow-tinted arcs of halos lay across the sky, and so distinct were these that a careless or thoughtless observer might easily have mistaken them for the 'wind-galls,' or portions of rainbows seen near the horizon on a wild showery evening. Close to the zenith a third spectrum was observed. After 10 a.m. the beauty of the halos faded, but the zenith circle was visible until mid-day. An attempt to explain briefly this beautiful display, to which the foregoing description does but scant justice, may not be without interest.



"The phenomena of halos, whether connected with the sun or moon, depend upon the presence in the air of innumerable crystals of ice, generally forming a light cirrus cloud. As is well known, cirrus cloud floats at a great height above the earth, far within the zone of perpetual frost. Experiment has proved that water crystallises in the form of regular hexagonal or six-sided prisms, sometimes with plane ends perpendicular to the sides, sometimes with hexagonal pyramids as terminals. The combination of any two non-parallel faces of such crystals must act as a prism, decomposing white light as it passes through them into its constituent colours. Every such crystal placed somewhere near the line joining the eye and sun must in general send to the former some definitely coloured ray from each effective pair of surfaces. The refractive index of ice, however, is such that no ray can pass through a prism of

it whose angle is greater than about 99·5°, and we are therefore limited to pairs of faces whose inclination is not superior to this. The most important pairs are two *alternate* faces of the prism, where the inclination is 60°, and a face with a terminal plane, the angle being 90°. If, then, there are in a cloud innumerable prisms of ice, with refracting angles of 60°, those prisms which are nearly in a line between the sun and the spectator will refract light in different directions. But there is a position of the vertical prism called that of 'minimal deviation,' for which a slight alteration of the prism produces no alteration in the direction of the refracted ray. Those prisms, then, which are near the position of 'minimal deviation' will conspire to refract light in the same direction and their effects will be added. The appearance, will, therefore, be a circle of reddish light surrounding the sun as centre, its angular radius being the angle of minimal deviation, which for a prism of ice of 60° angle is about 21° 50′. The light reflected from the surfaces of the prisms will be white and uniformly diffused about the sun. To right and left of the sun and on the halo, bright coloured images of the sun, called parhelia (from the Greek words, *para*, near, and *helios*, the sun), are formed by an excess of the prismatic crystals having their axes vertical or horizontal. The halo of 46° depends upon the right-angled prisms, formed by combining a terminal plane with one of the faces of the hexagonal prism. The refracting angle is different, and so this halo is of greater dimensions than that of 22° radius.

"The beautiful white zone around the zenith is produced by the reflection of light from the surfaces of the vertical prisms, which are so many vertical mirrors, in accordance with optical laws appearing to have the same altitude as the sun itself. From the foregoing, then, it would appear that the coloured circles are the result of refraction from prisms having angles of either 60° (halos of 22° radius), or 90° (halos of 46° radius), whereas the white circles are caused by reflection from countless tiny ice mirrors suspended high in mid air. It only remains to mention that the halo-producing sheet, 'formed'—to use the words of the Rev. Clement Ley—'by the interlacing fibres of more or less cirriform cloud,' is frequently the harbinger of storm and rain; for in front of an advancing barometrical depression, or cyclonic system, there commonly exists in the higher regions of the atmosphere a great bank of frozen moisture with its millions of ice prisms and mirrors. Yesterday's magnificent halos only too truly forshadowed the night of wind and rain which has just passed over this country.*

"In conclusion, we would direct the attention of those who are interested in the subject of halos and parhelia, to an admirable article in Vol. V. of *Chambers' Encyclopædia*, on which, indeed, the foregoing brief explanation has been based."

Yours very truly, J. W. MOORE, M.D.

40, *Fitzwilliam-square West, Dublin, Sept. 26th*, 1879.

* The barometer at Stornoway fell 1·25 inches, to 28·37 inches, in the twenty-fours ending 8 a.m. of Tuesday, Sept. 23rd.

A SOLAR HALO.—Mr. Carey Coombs, M.D., writes to us from Castle Carey, Somerset:—"At noon on the 22nd instant, while driving near Ditcheat (a village twenty miles south of Bath), I saw, in the zenith, a large white circle (the halo of 46°). This circle cut a smaller coloured circle which surrounded the sun (the halo of 22°), forming at the points of intersection mock suns or parhelia, which were coloured. An arc of another circle, beautifully coloured, touched the highest point of the halo of 22°, and the whole effect was beautiful. It is supposed that solar halos are produced by the refraction of the sun's rays from the surfaces of hexagonal prisms of congealed watery vapour—high up in the atmosphere—rainbows being formed by similar refraction from spherical rain drops. The sun at noonday is not a pleasant object to look at, and it is possible that solar halos are often overlooked, but their supposed rarity in our latitudes has induced me to record what I saw on Monday."—*Daily Telegraph.*

A CORRESPONDENT of the *Bristol Times and Mirror*, writing from Weston-super-Mare, says :—"A singular phenomenon was observed on Monday. Mr. Courtney, the School Board officer, while on the Esplanade, was watching what he took at first to be a 'sun dog' (a sailor's term for broken segments of rainbows), when he noticed a well-defined and perfect circle of light, the centre of which was opposite to and about 45° from the sun, and the periphery of which passed through the sun's centre. The diameter of the circle, measured from the sun's centre northwards, was about 90°, the northern boundary being about as far above the northern horizon as the sun is south of the zenith. He hastened home and got the correct time (it was just apparent noon), the sun's azimuth, and some rough measurements of the circle by sextant, applying at the same time a telescope of low power to the examination of the composition of the circle boundary line. From this observation he was satisfied that the circle was formed, not as is usual in solar halos, by a dark shadow filling up the circumscribed space, but by a boundary line of light, fleecy cloud, or mist, arranged in a thick and somewhat broken band of a degree or two in width. At one o'clock this band began to break up, and at 1.15 it had dispersed and disappeared, except that here and there within the space of the circle, the same fleecy cloud or mist was arranging itself, appearing and disappearing in streamers and tresses like waving masses of hair. There was bright sunshine, though the sky was leaden-hued, and the atmosphere warm and moist and sultry. The barometer was falling rapidly, and the occurrence was followed by strong gales through the night."

METEOROLOGY IN JAVA.*

WE are very glad to find that Dr. Bergsma is steadily continuing the system which he commenced in 1864, and that the quality of the work issued under his superintendence is, taken as a whole, highly creditable. The first volume of the Batavia Observations was the subject of a long notice in this Magazine for September, 1872; the second and third volumes have just appeared, and we, therefore, proceed to give a short notice of the steps taken by the Dutch Government towards ascertaining the climatic conditions of Java, Borneo, and other parts of the Malay Archipelago. And first as to head quarters—Batavia Observatory. When Dr. Bergsma, after making himself familiar with the routine of the best European observatories, arrived at Batavia and prepared the plans for a permanent observatory, he found that it would be very costly, and while sending in the estimate for a permanent building, he decided on renting a house one story high and surrounded, like most of those in Batavia, by a garden nearly four acres in extent, and using part of this house as a temporary observatory. It is fortunate that he adopted this course, for it was several years before the Government felt justified in voting the funds requisite for the purchase of the temporary house and grounds, and for the erection thereon of the permanent observatory. As it is, there will be nearly fifteen years' records of hourly readings at the temporary observatory, which can easily be connected with the results of the self-recording instruments in the permanent observatory, and will add enormously to the utility of its records.

* Observations made at the Magnetical and Meteorological Observatory at Batavia, by Dr. P. A. BERGSMA. Large 4to, Vols. II. & III., 1878. Government Printing Office, Batavia.

As regards the Archipelago in general, we reprint the paragraph in which Dr. Bergsma explains the state of matters; it is evidently so satisfactory as to need no comment from us.

"The organization of meteorological stations at other places in the Archipelago will not meet with such great difficulties as the erection of the central observatory; the expenses will be relatively small, and the observatory will afford ample opportunity for obtaining well trained native observers, able to make the observations at the stations under the superintendence of surgeons of the army, or other government officers. A first step has already been made by the organization of a great number of stations spread all over the Archipelago, at which observations of the rain will be made, principally by surgeons of the army and other government medical officers. On January 1st, 1879, these observations, to be published regularly by the Batavia Observatory, will begin at 95 stations, of which 55 are situated on the island of Java, 22 on Sumatra, 2 on Bangka, 1 on Bileton, 8 on Borneo, 4 on Celebes, 1 on Amboina, 1 on Banda, and 1 on Ternate; to which stations I hope 20 or 30 more will be added in the course of next year."

Although these splendid volumes contain a mass of tables, and the results are most fully and carefully worked up, we have not noticed any compact synoptical table; we have, therefore, compiled the following, which gives most of the principal elements, all expressed in English measures.

TABLE I.

BATAVIA (TEMPORARY OBSERVATORY).

Lat. 6° 11′ 0″ S. Lon. 106° 49′ 45″ E. Altitude 22 ft.

PERIOD.	1866–1875.				1864–75.	
ELEMENT.	Mean Temperature.	Mean Pressure at 32° at 25ft. above Sea.	Mean Elastic Force of Vapour.	Mean Humidity.	Mean Rainfall.	Mean No. of days with Rain.
MONTH.	°	in.	in.	0—100.	in.	
January	77·2	29·869	·819	88	16·97	24
February	77·3	29·861	·826	88	14·53	21
March	78·4	29·866	·831	86	7·36	15
April	79·2	29·852	·846	85	4·17	12
May	79·3	29·851	·839	84	3·58	9
June	78·8	29·869	·819	84	3·94	8
July	78·1	29·878	·783	82	2·52	7
August	78·7	29·879	·767	79	2·40	6
September	79·2	29·886	·783	79	3·15	8
October	79·2	29·871	·804	81	5·67	11
November	79·0	29·869	·815	83	5·04	12
December	77·6	29·860	·811	86	12·01	19
Year	78·5	29·868	·812	84	81·34	152
Absolute Max.	92·7	30·056	1·078	100	—	—
,, Min.	66·9	29·646	·472	32	—	—
Mean Daily Range	10·6	0·107	·055	24	—	—

In our previous notice we complained of the position of the rain gauge on the roof of the house; we adhere to that complaint, but we know full well how scarce are trustworthy records from the Malay Archipelago, and we have therefore converted and prepared the following abstract:—

RAINFALL AT BATAVIA.

YEAR.	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1864–75
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Jan....	20·16	24·65	8·47	20·67	10·16	11·85	9·37	23·43	35·55	12·01	14·25	13·23	16·97
Feb....	7·68	4·53	24·57	24·49	9·17	16·85	11·65	14·33	16·81	13·39	12·01	18·98	14·53
March	5·63	8·66	4·68	2·24	7·09	5·12	2·40	7·60	13·78	14·69	7·32	9·21	7·36
April..	3·58	6·89	3·42	1·85	3·86	4·41	4·03	5·71	·94	4·53	2·13	8·62	4·17
May...	1·81	·75	14·45	·67	·55	5·55	3·23	5·59	4·61	1·22	3·98	·43	3·58
June..	2·79	10·04	·24	1·38	1·14	7·48	6·22	2·91	2·68	1·61	10·59	·04	3·94
July...	2·60	1·57	·39	2·91	3·15	2·60	1·89	2·20	7·05	·59	5·20	·04	2·52
Aug...	3·03	4·88	·16	1·34	6·69	·28	3·35	·08	1·89	2·28	3·90	1·06	2·40
Sept...	2·28	1·69	5·63	3·35	·24	3·70	6·53	4·10	1·65	·55	6·97	1·18	3·15
Oct....	7·32	·20	6·81	10·31	3·58	7·28	5·12	6·85	5·55	1·42	3·74	9·73	5·67
Nov...	3·23	10·20	2·83	5·83	4·02	1·38	6·61	2·76	6·57	1·65	8·74	6·57	5·04
Dec....	4·73	9·45	17·72	21·42	7·48	13·74	24·61	18·62	6·61	5·91	3·03	10·75	12·01
Total..	64·84	83·51	89·37	96·46	57·13	80·24	85·01	94·18	103·69	59·85	81·86	79·84	81·34

	Maximum.		Mean.	Minimum.	
	Amount.	Date.		Amount.	Date.
Fall in a year ...	103·69	1872	81·34	57·13	1868.
,, ,, month.	35·55	January, 1872	6·78	·04	June& July, 1875.
,, ,, day ...	7·29	May 15, 1866	·54	·00	
,, in an hour...	3·83	Jan. 10, 1867	·15	·00	

We trust that Dr. Bergsma has ere this started a new and properly placed rain gauge, and that he has seen and will loyally follow Rule II. of the British Rainfall system, which says—

"II.—OLD GAUGES.—Old established gauges should not be moved, nor their registration discontinued until, at least, two years after a new one has been in operation, otherwise the continuity of the register will be irreparably destroyed. Both the old and the new ones must be registered at the same time and the results recorded for comparison."

Dr. Bergsma and his staff appear to be so careful, and the Director seems so desirous of rendering his work as nearly perfect as possible, that we have no doubt as to this little matter being properly attended to.

We cannot spare space for further extracts, but we desire to call attention to the author's remarks on cases in which Bessel's formula gives results evidently erroneous.

THE BRITISH ASSOCIATION AT SHEFFIELD.

(Continued from page 125.)

ON THE QUANTITATIVE ELEMENTS OF HYDROGEOLOGY. —PERCOLATION.

By JOSEPH LUCAS, F.G.S., Hydrogeologist, late of H.M. Geological Survey.

Divisions of the Rainfall Year.—Among observers of percolation, Mr. Evans divides the year into the winter half, October 1 to March 31, and the summer half, April 1 to September 30. Messrs. Lawes and Gilbert take the harvest year from September 1 to August 31. Mr. Greaves gives the amount for each quarter, and for the year ending at each quarter—March, June, September, and October. Ebermayer divides the year into four quarters—

Spring.....	March	April	May
Summer	June	July	August
Autumn.....	September	October	November
Winter	December	January	February

Giving his annual totals in respect of the twelve months, March—February.

In a paper* read at the Meterological Society, Mr. James Glaisher, F.R.S., supplies materials for comparing these various methods. He shows that the rainfall year divides itself into two halves, commencing March 1 and September 1, thereby proving the sagacity of Ebermayer.

Divisions of the Percolation Year.—The month of March contains the driest ten-day, fifteen-day, and thirty-day periods in the year, and the months of March and April the driest sixty-day period. The effect of this is manifested in the complete cessation of percolation in April. There is no such uniformity in the wettest periods of equal duration, and in consequence percolation does not recommence till the close of the longer wettest periods of thirty, sixty, and ninety days. Mr. Evans's soil gauge frequently leaves off recording percolation a month earlier, and begins to record it again a month later, than Mr. Greaves's. Mr. Evans's gauge is filled with a mixture of *gravel, loam,* and *mould,* and Mr. Greaves's of *gravel, loam,* and *sand,* which probably accounts for the difference in this respect.

Characters of the Soil.—The calibre of the constituent grains of the soil, and the per-centage of grains of various calibres in the natural admixture, should be known for every soil on which percolation experiments are or have been carried out. In a collection of grains of given calibre spheres will occupy more space than any other shape, or the absorbent capacity is least when the grains are spherical. The space occupied by any number of spheres, from one upwards, which exactly lie in a cubic foot, is ·5236 cubic feet as long as the arrangement is cubical, the retentive power increasing with the fineness of the grains. The natural arrangement is, however, pyramidal, in which one sphere rests in the hollow between four. As more spheres will thus go into a cubic foot the space occupied is somewhat greater than ·5236, and the absorbent capacity somewhat less than ·4764. The absorbent capacity (pyramidal) decreases with the diminishing calibre of the grains. The *absorbent capacity* is the space available for holding water between the grains of the soil. The *retentive power,* the quantity which the soil can hold by capillarity, increases with the fineness of the soil. The *percolative capacity* presents three cases :—1. Natural percolation from rainfall. 2. The percolative capacity at retentive point. 3. The percolative capacity under pressure.

Natural percolation depends upon the amount of, and difference between, the absorbent and retentive power, and so upon the calibre of the soil and the shape of the grains; the quantity of rain falling; the humidity of the soil at the time of the fall; the temperature of the soil, the percolating rain, and the air; and the humidity of the air; probably also on the elevation of the ground, for which see Dines "On the Temperature of Hill and Valley."†

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* "On the Fall of Rain on Every Day of the Year, from Observations extending from 1818 to 1869."—*Proc. Met. Soc.*, vol. v., p. 87.

† *Quar. Journ. Met. Soc.*, Ap. 17th, 1872.

Percolation commences when the degree of humidity of the soil just exceeds the retentive point. The absorbent capacity of a cubic foot of sand of less than ·035 in calibre was 730·8 cubic inches, or ·422 cubic foot, which equals a depth of 5 inches of rain on the square foot; its retentive power 461 cubic inches, which equals a depth of 3·208 inches of rain on the square foot. Such falls of rain in 24 hours are excessively rare, so that the soil is rarely or never saturated. It generally exists in a degree of humidity far below retentive point, so that only the excess over this deposit can percolate. The percolative capacity at saturation point requires to be determined experimentally; also the degree of humidity corresponding to the observed annual average natural percolation. Mr. Evans gives this as 8·227 inches for the 25 years, 1835–1860, which equals a daily transit of 3·24 cubic inches through each square foot. We do not know the average humidity represented by this percolation. Even when the humidity exceeds retentive point, percolation sets in, and a waterline is formed. The zero of percolation represents the minimum waterline, and saturation point the maximum waterline. Therefore *the degree of humidity*, *the quantity percolating*, and *the height of the waterline* can be expressed in terms of each other.

Temperature of Percolation.—The temperature of percolation has not been observed. Changes of temperature in the soil must act upon the contained moisture in the same way as they do in the air above, thereby tending to cause evaporation or to produce percolation. In an abstract of more than 100,000 observations upon the temperature of the soil made in the Gardens of the Royal Botanic Society, London, 1871–1876. Mr. G. J. Symons, F.R.S., shows that the heat wave commences in March, and spreads downward till the whole 4 feet of observation is warmer than the air in September and October; the effect of the preceding cold wave disappearing at 4 feet by the end of August. In November the cold wave commences and moves down till the whole 4 feet is colder than the air by the end of February, when the heat wave begins again. This corresponds with the division of Ebermayer on March 1 as regards the commencement of the heat wave at the surface and the disappearance of the preceding heat wave at 4 feet; and on September 1 as regards the disappearance of the preceeding cold wave at 4 feet, *but not as regards the surface*, the heat wave lasting till the end of October. These heat divisions correspond with the "least rain" periods of Glaisher which occur in February and March, the last two months of the cold wave, and with the "heaviest rain" periods which end with the heat wave at 3 inches in October; with the cessation of percolation in March (when the heat wave begins) and its recommencement in November (when the cold wave begins).

In reference to future observations on percolation, therefore, it is suggested that:—

1. Artificial admixtures should be avoided.
2. The calibre of the constituent grains, and the percentage of grains of each gauge in the natural admixture, should be experimentally ascertained.
3. The absorbent capacity should be measured.
4. The retentive power should be proved.
5. The percolative capacity at saturation point, and as far as possible at less degrees of humidity, should be measured.
6. The percolative capacities under pressure greater than that of saturation should be proved.
7. Percolators should contain thermometers.

There should be a set of three cylinders—A, *the saturated cylinder*, filled with saturated soil, closed top and bottom, and provided with thermometers.

B a common Dalton gauge, provided with thermometers.

C the dry cylinder, filled with dry soil, closed top and bottom, and provided with thermometers.

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* *Proc. Inst., C.E.*, vol. lvii., p. 3, 1879.

SUPPLEMENTARY TABLE OF RAINFALL IN SEPT., 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	2·79	XI.	Port Madoc	3·47
,,	Littlehampton	3·86	,,	Douglas	4·87
,,	Dorking, Abinger	3·84	XII.	Carsphairn	7·25
,,	Hastings, Manor House	2·97	,,	Melrose, Abbey Gate...	1·37
,,	Hailsham	3·13	XIV.	Douglas Cas., Newmains	3·56
,,	I. of W., St. Lawrence.	3·52	XV.	Islay, Gruinart School..	6·13
,,	Strathfield Turgiss	2·39	XVI.	St. Andrew's, Cambo...	...
III.	Great Missenden	3·50	,,	Aberfeldy H.R.S.	3·39
,,	Winslow, Addington ...	2·94	XVII.	Tomintoul	1·38
,,	Oxford, Magdalen Col...	2·87	,,	Keith H.R.S.	1·14
,,	Northampton	2·80	,,	Forres H.R.S.	·76
,,	Cambridge, Merton Vil.	2·59	XVIII.	Strome Ferry H.R.S....	8·40
IV.	Harlow, Sheering	3·42	,,	Lochbroom	5·32
,,	Diss	4·12	,,	Auchnasheen H.R.S. ...	...
,,	Swaffham	3·34	,,	Tain, Springfield	·94
,,	Hindringham	2·82	,,	Loch Shiel, Glenfinnan.	16·39
V.	Salisbury, Alderbury...	3·63	,,	Dalwhinnie H.R.S.....	...
,,	Calne, Compton Bassett	3·46	XIX.	Lairg H.R.S.	...
,,	Beaminster Vicarage ...	4·86	,,	Altnabreac H.R.S.	1·80
,,	Dartmoor Prison	...	,,	Watten H.R.S.	1·96
,,	Langtree Wick	4·33	XX.	Fermoy, Glenville	3·72
,,	Lynmouth, Glenthorne.	5·59	,,	Tralee, Godfrey Place...	...
,,	St. Austell, Cosgarne...	3·76	,,	Cahir, Tubrid	2·47
,,	Taunton	2·25	,,	Tipperary, Henry St....	2·93
VI.	Bristol, Ashleydown ...	3·89	,,	Newcastle West	3·32
,,	Wem, Sansaw Hall.....	3·21	,,	Kilrush	4·82
,,	Cheadle, The Heath Ho.	2·71	,,	Corofin	4·70
,,	Bickenhill Vicarage ...	3·39	XXI.	Kilkenny, Butler House	3·86
VII.	Melton Mowbray	3·29	,,	Carlow, Browne's Hill..	4·71
,,	Horncastle, Bucknall...	3·43	,,	Kilsallaghan	3·45
VIII.	Walton-on-the-Hill.....	3·00	,,	Navan, Balrath	3·96
,,	Broughton-in-Furness..	5·77	,,	Athlone, Twyford	5·50
IX.	Wakefield, Stanley Vic.	1·31	,,	Mullingar, Belvedere...	4·40
,,	Ripon, Mickley	1·80	XXII.	Ballinasloe	4·50
X.	Gainford	1·43	,,	Clifden, Kylemore	11·29
,,	Haltwhistle, Unthank..	1·53	,,	Crossmolina, Enniscoe..	4·59
,,	Shap, Copy Hill	4·95	,,	Carrick-on-Shannon ...	6·31
XI.	Llanfrechfa Grange	5·44	,,	Dowra	5·43
,,	Llandovery	5·57	XXIII.	Rockcorry	5·01
,,	Solva	3·95	,,	Warrenpoint	5·98
,,	Castle Malgwyn	4·78	,,	Newtownards	3·86
,,	Rhayader, Nantgwillt..	5·27	,,	Larne, Carnlough	4·54
,,	Carno, Tybritle	4·81	,,	Bushmills	3·92
,,	Corwen, Rhug	2·79	,,	Buncrana, Rockfort ...	5·11

SEPTEMBER, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	3·67	+ 1·41	1·49	23	12	72·6	4	39·6	1	0	0
II.		Maidstone (Hunton Court)	2·50	+ ·38	·96	23	13	...	...	...	...	...	...
III.		Selborne (The Wakes)	3·76	+ 1·32	1·02	23	16	68·0	6	34·0	1	0	0
"		Hitchen	2·71	+ ·85	·53	23	16	64·0	3,6	38·0	24	0	...
"		Banbury	2·99	+ ·62	·65	28	16	68·0	3	35·0	1	0	...
IV.		Bury St. Edmunds (Culford)	3·71	+ 2·10	1·41	23	14	71·0	7,8	38·0	15†	0	2
"		Norwich (Cossey)	3·43	+ 1·64	1·23	23	14	72·5	3	34·0	28	0	1
V.		Bridport	3·33	+ 1·01	·87	23	13	...	...	...	...	...	...
"		Barnstaple	3·66	— ·10	·52	6, 12	18	75·0	7	40·0	1	0	...
"		Bodmin	4·30	+ ·63	·84	6	17	67·0	15	43·0	25	0	0
VI.		Cirencester	3·65	+ ·79	·66	23	14	...	...	...	...	...	...
"		Shifnal (Haughton Hall)	2·69	+ ·74	·60	24	17	67·0	6	33·0	30	0	1
"		Tenbury (Orleton)	3·25	+ ·57	·51	30	18	77·3	6	33·0	30	0	2
VII.		Leicester (Town Museum)	3·33	...	·68	13	15	69·1	3	35·2	30	0	3
"		Boston	3·45	+ 1·88	·64	28	17	73·0	3	37·0	30	0	...
"		Grimsby (Killingholme)	2·77	...	·88	13	13	70·0	7	37·0	30	0	...
"		Mansfield	2·62	...	·53	24	13	70·3	3	31·9	31	1	0
VIII.		Manchester (Ardwick)	3·13	— 0.5	·72	12	16	70·0	6	42·0	28,29	0	0
IX.		York	2·07	— ·26	·30	8	14	72·0	7	32·0	30	1	2
"		Skipton (Arncliffe)	3·90	— 1·06	·94	25	20	...	...	...	...	...	...
X.		North Shields	·73	— ·97	·19	21	14	65·0	3	37·0	30	0	0
"		Borrowdale (Seathwaite)	16·67	+ 3·46	3·06	11	24	...	...	...	...	...	...
XI.	WALES.	Cardiff	4·85	...	·69	7	17	67·0	6	39·5	1	0	...
"		Haverfordwest	5·26	+ 1·55	1·06	11	18	67·0	6	34·0	29	0	1
"		Lampeter (St. David's Coll.)	...	...	...	...	...	...	...	...	...	...	...
"		Llandudno	3·00	+ ·66	·72	26	17	67·0	6	42·0	30	0	...
XII.	SCOTLAND.	Cargen	5·63	+ 2·17	·89	30	17	68·4	6	32·4	27	0	3
"		Hawick (Silverbut Hall)	2·15	...	·50	30	16	...	...	..	...	...	...
XIV.		Annanhill	5·54	...	1·03	27	20	64·0	7	36·0	27	0	...
XVI.		Kilmory	8·61	...	1·05	27	23	...	...	34·0	3	0	...
"		Mull (Quinish)	11·57	...	2·02	1	26	...	...	...	...	...	..
"		Loch Leven	2·90	— ·13	·50	23	13	...	...	...	...	...	...
"		Loch Long (Arddaroch)	10·92	+ 4.24	1·41	28	21	...	...	...	...	...	...
XVII.		Arbroath	1·91	— ·61	·39	11	11	63·0	3*	35·0	27	0	...
"		Braemar	1·81	— ·83	·35	30	15	66·2	7	26·7	27	3	12
XVIII		Aberdeen	3·20	...	1·09	30	19	64·5	4	36·0	27	0	5
"		Portree	11.76	+ 1·00	2·45	2	26	...	...	...	...	...	...
"		Inverness (Culloden)	1·40	— 1·29	·56	12	...	66·3	7	37·1	27	0	4
XIX.		Dunrobin	1·56	— 1·21	·50	27	14	68·0	2	34·0	25	0	...
"		Sandwick	3·29	— ·37	·72	27	23	61·0	8	41·6	27	0	0
XX.	IRELAND.	Cork	...	...	...	...	...	...	...	...	...	...	...
"		Caherciveen Darrynane Abbey	4·53	...	·50	8	22	...	...	...	...	...	...
"		Waterford	5·34	+ 2·21	1·27	8	21	64·0	18	34·0	30	0	0
"		Killaloe	5·54	+ 1·38	·80	25	19	76·0	2	34·0	30	0	...
XXI.		Portarlington	5·23	+ 1·95	2·92	7	22	67·0	2	38·5	23	0	...
"		Monkstown, Dublin	1·79	— ·20	·55	7	14	...	...	...	...	...	...
XXII.		Galway	5·03	...	·78	27	22	63·0	6	40·0	24	0	...
XXIII		Waringstown	4·48	...	·90	7	19	68·0	6	33·0	23	0	1
"		Edenfel (Omagh)	6·55	...	1·52	7	26	66·0	15	30·0	23	1	...
"		Ballinful	4·83	...	1·38	7	19	...	...	...	...	...	...

* And 14, 19. † And 25, 27.

+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON SEPTEMBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

SELBORNE.—Prevailing wind, west.

BANBURY.—Some corn is yet uncut, and much remains to carry. Harvest deficient both in quantity and quality.

CULFORD.—Mean temp. of month 55°·4, and polar winds prevailed on eight days. The rainfall of the present year already amounts to 28·15 in., which exceeds the total fall of 14 out of the 20 preceding years. Severe TS on the night of the 16th.

COSSEY.—Most of the corn in this district harvested by the 27th. Two distinct currents of air, the upper from S.W., the lower from N.E., during the heavy rainfall on the morning of the 24th.

BODMIN.—Average temp. of month, 57°·8.

CIRENCESTER.—Rainfall still above the average, but less than either of the preceding summer months. Not a good month for the harvest, which is unusually late.

SHIFNAL.—The first week brought a prospect of a change from the persistent R of August, but on the 7th it set in again and fell daily for a week. Harvest sadly prolonged, much wheat still uncut. Very few wasps, not one mushroom.

ORLETON.—The first six days were fine, pleasant, warm, and dry, but on the 7th R set in again, and the remainder of the month was cloudy and gloomy, with frequent heavy falls of R and very little sunlight. Mean temp. a little more than 1° below the average, making the eleventh month in succession with a mean temp. below the average. Much of the white straw crops is now cut, but very little is carried, and in damp situations the grain is beginning to sprout. It is the latest harvest ever remembered.

BOSTON.—The weather has been most unfavourable for harvest. Scarcely any white corn is yet carried, and beans are not yet cut; the sheaves stand soaking in the fields, and dry but little when the days are fine, owing to the absence of wind and sunshine. The harvest is the latest known since 1860. Wheat was not in ear till the end of the first week in July; in 1860 it was a few days later. The average time for this district is the 16th of June, the earliest being May 27th, 1868, in which year the mean temp. of May, June, and July were 8°, 3°, and 2° above the average respectively; this year the temps. of those months were 5°, 2°, and 5° below the average.

GRIMSBY.—The unsettled weather of the previous months still continued, and harvest work was a gloomy and depressing task; the close of the month gave no signs of any improvement, but even if the corn should be got in in fair condition, the quality and yield must be very inferior. Rime on ground on 27th.

NORTH SHIELDS.—Solar halo and parhelia on 22nd, solar halo on 27th, and lunar halos on 1st and 27th, TS on 8th.

SEATHWAITE.—Fearful storm on the 11th, 3·06 in. of R; TS on 7th; frequent frosts at night towards the close of the month, eight days with a rainfall exceeding 1 in.

WALES.

HAVERFORDWEST.—First five days fine and warm. A period of very wet weather then set in, lasting to the 12th, with high wind; from that time to the 19th, fine, clear, warm weather prevailed, of inestimable value to the harvest. The weather during the remainder of the month was most precarious—stormy, wet, and sometimes very cold. The oats, although a light crop, are heavy grain and excellent quality; barley is generally very poor.

LLANDUDNO.—A week of fine, dry weather from the 13th to the 19th in-

clusive ; rest of the month very variable, resembling a good deal the proverbial weather of April. Mean. temp. about 2°·5 below the average, and the rainfall about ·25 in. above.

SCOTLAND.

HAWICK.—With the exception of the 2nd, 3rd, 22nd, and 23rd, which were very squally, the month was a mild one. Farmers are now in the midst of harvest, and in order to secure their crops are scarcely waiting for the golden tinge of autumn, many fields being cut which are hardly ripe. The potato crop has not failed so completely in this district since 1847. All tender flowers blackened by the frosts of the nights of 20th and 25th.

QUINISH.—A very wet and stormy month. Wind from S.W. to N.W. the entire month. No corn in stack as yet, though the greater part has been cut for some time.

BRAEMAR.—The best month of the year. Crops still green, and now injured by frost.

ABERDEEN.—A month of fairly average weather. The crops were mostly still green on the 24th, when the frosts on the grass set in.

PORTREE.—A very wet and stormy month. Cutting is far advanced, but the crops are in a very bad state from the continuance of wet weather. A hurricane on 23rd from S. to W., 1 a.m. to 11 a.m., a great number of fruit trees and bushes broken.

CULLODEN.—Weather more favourable, little R and a considerable portion of the grain crops carried in fair condition, potato crop much diseased, turnip crop not rooting well. The heavy S.S.W. gale on 23rd did much damage in gardens and where grain crops were uncut.

DUNROBIN.—Weather generally during the month much improved ; wind mostly west.

SANDWICK.—Mean temp. low, in fact that of all the months this year has been below the average of the last 52 years. Such a continuance of cold weather makes the harvest uncommonly late ; half of the oat crop is not yet cut, and some of it cannot be expected to ripen now. H on 12th, sleet on 29th, a gale of 45 miles an hour from 9 till 11 p.m. on 3rd, and another of 50 miles an hour from 5 a.m. till noon on the 23rd.

IRELAND.

DARRYNANE ABBEY.—Except the five days, 14th to 18th, which were very fine, this was another wet and cold month. The rainfall to the end of the month is almost identical with that of the same period in 1872. The figures are :—1872 : 43·68 in., 209 days ; 1879 : 43·65 in., 209 days.

KILLALOE.—A very unfavourable month for harvest work, crops ripening slowly and unevenly from wet and absence of sunshine. Very serious damage to outstanding hay and potato crop.

MONKSTOWN.—After the first week a very fine seasonable month, with comparatively little R, enabling farm operations to be prosecuted vigorously. A very fine solar halo and parhelia on 22nd. No visible frost as yet.

OMAGH.—The weather of September has been no improvement on that of the months preceding, extremely heavy rainfalls, frequently accompanied by gales, having been its chief feature ; but notwithstanding this summerless year a heavy hay crop has been well saved, and an equally heavy oat harvest is now in operation. On the whole the prospect is not disheartening.

THE WEATHER IN SEPTEMBER.

At the beginning of the month a large anticyclone (with readings above 30·4) lay over the southern parts of England and Ireland ; and fine weather prevailed in most parts of the country. On the 2nd, however, the high pressure

gave way, and depressions began to appear, passing along our western and northern coasts and causing rain in those localities, and cloudy weather even in the South and East. Another anticyclone established itself over this kingdom on the 4th, but on the 5th disturbances again began to appear in the West, and continued to pass in a northerly direction along our western coasts till the end of the week. The winds were strong to a gale in the North-west and North at the beginning and end of the week, but generally moderate in the East and South.

A large, but somewhat shallow, depression lay over our western coasts at the early part of the second week. The disturbance, after moving slightly to the North-west, and becoming deeper, suddenly changed its course and passed in an almost easterly direction across our Islands, causing in its passage strong winds generally, and a W. gale on the west coasts. The winds subsequently veered to N.W. and fell moderate; but on the 11th they returned to S.W., and breezes from that quarter or from W. continued through the remainder of the week, by which time light E. airs were beginning to show themselves on our South coast. The weather during this week was generally unsettled, and heavy rain fell in the west on the 11th, and in the south on the 13th.

The weather during the third week was comparatively quiet. At first pressure was highest on our south-west coast, and an arm of high readings spread eastward over these Islands. During the 17th and 18th, readings were highest over Sweden, with a band stretching westward over the North of England and Ireland, so that N.E. to E. breezes had spread northwards over the greater part of England, while the W. breezes still continued in the north. On the 19th pressure rose quickly, and an area of high bar. readings was formed over these Islands, with light N. breezes, but very cloudy, dull, or misty weather. On the evening of the same day, a fall of the barometer began in the north-west, which became brisk during the night and spread to all our coasts, so that on the following morning the charts shewed an area of high pressure lying over France and the South of England. with a rather important depression to the northward of Scotland. Brisk W. breezes prevailed generally, but the weather, though cloudy and unsettled in the W., was fine and bright in the E. after noon of the 20th.

During the former half of the last week the weather over these Islands and their neighbourhood was in a very unsettled state. On the 21st the wind was W., and the weather generally cloudy and cool; but by the following morning, when the wind had veered to N.W. or W.N.W., the weather had cleared considerably and was generally fine though cool. During the 22nd, however, a rapid fall of the bar. occurred, and on the next day a depression (which caused a fall of 1·25 in. at Stornoway, and a more or less rapid fall over West Europe) was shown off the N.W. coast of Scotland, bringing fresh to hard S. to S.W. gales on our coasts. A rapid recovery succeeded this depression in the north; but in the south a shallow subsidiary appeared, and passed across the South of England, occasioning very heavy rain and a considerable increase of wind. During the 24th the bar. rose everywhere, and on the 25th an area of high pressure was shewn over France, with a depression off the West coast of Norway, a distribution which caused moderate to fresh W. winds, and very fine weather. From then till the close of the week the bar. continued to rise, and very fine weather with W. winds was experienced; but on the 27th, a fresh fall of the bar. occurred in the west, accompanied by a strong S. wind and overcast skies, and this change gradually spread eastward to all parts of these Islands. The weather continued unsettled during the remaining three days of the month.

Temperature during the first half of the month was below the average, particularly so the first week, but the third week showed a material improvement. Temperature of course decreased as the month drew to a close.

HORACE E. MILLER.

Lowestoft.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLXVI.] NOVEMBER, 1879. [PRICE FOURPENCE. or 5s. per ann. post free.

RAINFALL STATIONS.

WITH the observation to be made at 9 a.m. on the first of January next, will end the second decade of systematic rainfall work, and immediately afterwards the third decade will begin.

What changes the coming decade has in store no one can tell; several hundred of our correspondents will cease observing; the direction of the organization may pass from my hands; but I believe that the utility of the careful registration of the fall of rain will be increasingly recognised as years roll on, and that either by myself, by a successor, by some society, or by Government, the work will undoubtedly be continued.

This being my belief, what is my duty, and that of all who wish to render our organization in all respects more powerful? I think there are only two things to be done—to obtain more observers and to obtain more money.

Additional Observers.—Complaint has been made that with a staff of more than 2,000 observers, it is unreasonable to ask for more. I will state a few facts which will explain and illustrate the necessity:—

(1). The deaths average 30 per annum; this alone would, therefore, diminish the staff by 300, or 15 per cent. in the ten years.

(2). There are many removals; many observers who, from various causes, are obliged to discontinue their records; and a few, very few, who do so voluntarily. The records terminated by these classes together probably exceed those terminated by the death of the observers; and when we add records spoiled by accidents to the gauges, by fire, and the many other vicissitudes which come to my knowledge, I am inclined to believe, (*a*) that it would be unwise to calculate that more than 800 perfect records for the decade 1880-89 would be obtained from the present staff of observers, and (*b*) that if no fresh observers were obtained the staff in 1889 would not much exceed 1,000.

(3). Even with the present far larger staff, we have not a proper representation of the country. For instance, North-east Yorkshire, South and also South-west Denbigh, North Anglesea, North-east

Pembroke, North Brecknock, and South Radnor greatly need additional stations. The following counties have only one station in each, viz., Clackmannan, Kinross, Carlow, Kildare, Roscommon and Monaghan; and, lastly, the Isles of Alderney and Sark and the County of Longford are without any station at all.

(4). As we know by experience (see, for example, *British Rainfall*, 1871, page 8) that even a county well provided with stations may in a few years be left almost without any, it is not merely desirable that the districts above mentioned should be provided with additional observers, but that additions should also be made in many other localities.

(5). *Hence it appears desirable that from* 100 *to* 200 *new observers should be obtained*, and that they should begin observing on December 1st, so as to be thoroughly used to the work before the beginning of the new year.

I need hardly say that I shall cheerfully accept help from any quarter, and that I am quite ready to render any assistance in my power.

Additional Subscribers.—The cost of the rainfall organization has not only grown with its growth, but has grown faster, because the work has become more thorough, at the same time that there has been a larger number of records to examine. Any one who will take the trouble to compare the annual volumes of *British Rainfall*, will find that the brain-work requisite for the compilation of the later volumes far exceeds that for the earlier ones. And so, what with paying for assistance, for printing, engraving, and postages, the total outlay is very large. Upwards of 1,000 observers do not contribute a single penny towards this outlay, and therefore it falls more heavily upon the 1,000 or 1,200 who not only observe, but contribute towards the cost of reducing and printing their observations. Death, however, is constantly lessening the number of subscribers, and therefore new ones must be obtained. I should have preferred that some one else should make this request; as long, however, as the system remains without endowment or Government assistance, the losses by death must be made up, and this year there are not only the average deficiences from that cause, but in addition many subscriptions have been withdrawn in consequence of commercial and agricultural depression; in fact, this has been so serious that I have been obliged to abandon several stations in mountain districts which I have hitherto kept up by paying shepherds, gamekeepers and others for making the observations.

On all these grounds I ask for additional observers and additional subscribers.

G. J. SYMONS.

THE WEATHER IN OCTOBER.

THE unsettled weather which, during the last ten days of September was general or nearly so, continued during the first four days of October. On the evening of the 1st the barometer was rising and the weather fine, but on the following day several slight depressions passed across these Islands, causing

showers and unsettled weather in many parts. On the 3rd the sky was clear over France and the S.E. of England, while elsewhere the weather was cloudy; moderate to fresh W. winds prevailed all over this country, and the bar. was rising briskly except in the north of Ireland; where a rather brisk fall had set in, but the disturbance which was the cause of it proved to be of but small importance. The bar. consequently continued to rise generally, a large anticyclone was formed over France and the south of England, while the weather became fine and settled with light S.W. to W. winds.

The weather during the week (5th–11th) was very quiet. A rather brisk fall was reported on the morning of the 5th in the south of Ireland, with a S.E. gale in the south-west of Ireland; but the anticyclone which lay over Great Britain, the North Sea, and the Netherlands subsequently spread out over the whole of these Islands and their neighbourhood, so that while E. winds of moderate strength prevailed over France, and N.W. winds over Sweden and Norway, very light breezes or calms were reported from these Islands. The sky, though cloudy and foggy during the mornings and evenings, was clear and bright generally during the early part of the week; but towards the close of the week the fog and gloom lasted through the day.

The next week's weather may be divided into two kinds. At first an area of high pressure extended from Ireland eastwards as far as North Germany, so that while W. breezes prevailed on our northern coasts, over the North Sea, and in Scandinavia, E. breezes blew in the south of England and over France. The weather during this period, which lasted until the morning of the 14th, was dry, though foggy and dull, with low temperature. On the 14th a depression passed southward along our east coast, and N. winds prevailed generally, with cold, raw weather; and these conditions continued, in a lesser degree, throughout the 15th. On the 16th a sudden change began; a brisk fall of the bar. occurred at Stornoway with a S.W. gale, and as the depression which caused the decrease passed over, S.W. to W. gales were experienced on all our more N. coasts, with a rapid increase of temp. On the 18th the bar. was rising quickly, the disturbance passing away eastward, and the wind (still blowing strong to a gale) had veered to N.W. or W., and at night temp. fell again quickly. On the next day a fresh fall appeared at Stornoway, the wind again backed to S., temp. rose, and there was every appearance of a renewal of the gale.

The weather continued unsettled during the following week, and considerable changes occurred. At first the weather was controlled by a large depression, which advanced from the W., passed to the northward of Scotland, and travelled across Scandinavia. During the first few days W. winds, strong to a gale, were experienced, with high temperatures; but on the 20th N.W. gales prevailed, and temp. fell fast, while on the 21st fine, bright, cold weather with moderate N.W. breezes was reported. On the 24th a large depression was shewn to the northward of Scotland, and a small subsidiary over the Irish Sea, the bar. was falling quickly, and the weather dull and rainy, but next day, when both disturbances had apparently travelled away eastward, the weather cleared and became fine and bright. By the evening of the 24th pressure was rising fast in the north, and a complete reversal of the pre-existing conditions seemed probable.

This probability the weather of the next few days proved a certainty, pressure increasing everywhere, and a large area of high readings being shown over Scandinavia and our north coast on the 27th, which by the 28th had shifted to the east of England, the North Sea, and the south of Scandinavia, the weather in the meantime being for the most part dull, or misty and showery. The area of high readings in the north of Great Britain maintained itself till the close of the month, and the weather continued cloudy or dull. Temperature during this period was very variable, the highest temp. in these Islands being in the S.W., and the lowest in the N. or N.E.

Temperature during the first ten days of the month was low, and the rest of the month was subject to sudden and extensive variation.

H. E. M.

Lowestoft.

LIGHTNING CONDUCTORS.

To the Editor of the Meteorological Magazine.

SIR,—In the summer of 1878 delegates were nominated by the following societies, viz., the Royal Institute of British Architects, the Society of Telegraph Engineers, the Physical Society, and the Meteorological Society, for the following purpose :—

"To consider the possibility of formulating the existing knowledge on the subject of the protection of property from damage by electricity, and the advisability of preparing and issuing a general code of rules for the erection of Lightning Conductors."

The delegates have held several meetings, and have already collected, firstly, from the manufacturers of Lightning Conductors, and secondly, from the Members of the Royal Institute of British Architects, a large amount of thoroughly practical information. Several of their number are also engaged in forming abstracts of the salient features of the literature of the subject.

The Members of the Conference are, however, most anxious that their report should be as trustworthy and as exhaustive as possible, and they have therefore instructed me to ask you to assist them by publishing this epitome of their proceedings, and allowing them to invite correspondence upon the points mentioned below.

I am, Sir,
Your obedient servant,
G. J. SYMONS, F.R.S.,
Secretary to the Conference.

Lightning Rod Conference,
30, *Great George Street, S. W.*

CLASS OF FACTS MOST REQUIRED.

Full details of accidents by lightning, stating especially whether the building struck had a conductor or not. If there was a conductor, state its dimensions—construction—mode of attachment to building—whether its top was pointed—distance of its upper terminal from the place struck—nature and extent of the connection between the conductor and the earth, and whether the earth was dry or moist—whether the conductor was itself injured—and whether the conductor or the point struck was the most salient object in the vicinity. Information is also desired, either verbally or by sketches, as to the position of metal spouting and lead roofing relatively to the point struck, and to the conductor.

Details of the thickest piece of metal melted by a flash of lightning are much needed.

Unimpeachable evidence of the failure of conductors is much desired, as such failures would be extremely instructive.

BIBLIOGRAPHY.

WE are very glad to report that Prof. Cleveland Abbe has completed his card catalogue of the meteorological papers indexed in the Royal Society's catalogue. Mr. Wheatley, the Secretary of the Index

Society, announces this fact in *Nature* of October 30th, and we hasten to bring it before the meteorological world at large. Surely the United States Government, which is so wisely liberal in all that relates to publication, will at once direct that this catalogue, which would be of world-wide utility, shall be printed. We know few pieces of work which would reflect more credit on the United States Signal Office, and on all who have had a share in the work.

And even if the Signal Office is unable to publish it, the Regents of the Smithsonian Institute will surely not neglect an opportunity precisely consonant with the intentions of the founder of that noble institution.

We sincerely hope that before another year has passed we shall be able to tell our readers not merely that the meteorological papers are catalogued, but that the catalogue is printed.

As to the catalogue of meteorological books, *i.e.*, separately published works, we have no later intelligence than that given in our June number.

REVIEWS.

The Collinsville Tornado of April 14th, 1879. By J. L. R. WADSWORTH, M.D., and F. E. NIPHER. [From the Trans. of the Academy of Science of St. Louis Vol. IV., No. 1.] 8vo, 20 pages and two maps.

A FULLY worked out description of one of those destructive tornadoes which years ago were regarded as being chiefly fiction founded upon fact, but which the careful records of the United States Signal Office and such documents as the present prove to be sad realities.

Dr. Wadsworth's personal narrative of the storm is as follows :—

"At 2.35 p.m., St. Louis time (definitely known), I was aroused by an exclamation from Mrs. W., and simultaneously our help cried out, 'The mill has blown up!' (referring to a planing-mill in a lumber-yard on the block west of us). We immediately sprang to the window (open south) and saw lumber, shingles, great sections of wooden sidewalk, limbs of trees, flying through the air; and so very thick did the air seem to be filled, that it was impossible to see across the street. Rushing to the door, the air was still filled with fine débris of leaves, pieces of old shingle, bark and twigs, borne along with a strong wind accompanied by a little rain. Passing out to the street, it was absolutely impossible for vehicles and very difficult for pedestrians to clamber over the great piles of rubbish, composed of trees, fences, wooden walks, lumber, &c. For three-fourths of a mile down the main street of our little town lay the work of this terrific force. After traversing this distance, we returned to extend the examination in the other direction, and not until we had passed our first starting-point two blocks did the return current coming from the north reach us, bearing a tremendous storm of hail and rain, accompanied by a terrific electrical display. Would judge the storm continued unabated for 45 minutes.

"Finally, as the result of not far from one minute's work, we find in Collinsville 109 buildings more or less injured (24 entirely, 25 partially swept away or crushed, and 60 slightly injured), and involving the loss of one human life and seven wounded. Such is a brief view of the tornado. Although severely felt by those who suffered by it, yet, in comparison with many others that

have occurred in this and adjoining States, this exhibited much less force and was followed by much less loss of life and property."

As regards damage, most of the details are of the usual kind, and need not be reproduced here; the following is novel, but the mechanical force exerted was probably less than in some of the other cases :—

"A horse and buggy, standing in front of a church in which a funeral was being conducted, was taken up into the air and whirled 260 feet distant, and dashed to the ground, killing the horse and but slightly injuring the buggy. Some by-standers claimed that this horse and buggy were carried fifty feet high."

We are rather surprised to find that the authors appear to regard the outbursting of buildings as an unusual phenomenon. They write, "an interesting phenomenon in connection with the tornado, and covering a large proportion of the destruction attending it, comes from a peculiar 'explosive action,'" and then Prof. Nipher adds the following note :—

"This is sometimes attributed to rarefaction of air outside of the house, the unbalanced internal pressure throwing the walls outward. To say, under the conditions which obtain in a tornado, that there is a tendency to rarefaction at the centre of the vortex, is equivalent to the statement that the wind is blowing.

"In case of a vortex approaching a building, the inrushing wind would cause a great pressure on the windward side of the house, and the pressure on the lee side would be less. The breaking of a window on the windward side would transmit the pressure to the interior. The support of the side walls would cause the lee wall to be most vulnerable. The side walls might also be started outwards, and the reverse winds, after the tornado has passed, would tend to throw the remaining walls outwards. The violence of the wind would, of course, determine the distance to which the ruins would be scattered."

Our own impression is that there is an enormous up-draught in the centre of every tornado, which diminishes the pressure upon the air in houses to such an extent as thereby to produce the "explosive action" above mentioned.

The Weather and Climatic Changes, by OBSERVATOR. Longley, Warwick-lane, London. 1879 : 16mo. 74 p.p.

A QUEER little pamphlet, of which the following is the preface :—

"This little Book is not intended "to supply a long felt want," nor put forth at the request of "numerous friends." The writer ventures to submit what may, at first, appear a novel theory on the change of climate ; and, in addition to his own observations, he has collated, from the accumulated weather-lore of past ages, such rules as may prove useful to those who believe that "to be forewarned is to be forearmed ;" for the all-absorbing subject, "The Weather," has long continued to cause us more anxiety than all our money, or the want of it."

The novel theory referred to above appears to be that the recent exceptional weather is due to the increased consumption of coal and the diffusion of the gaseous products of its combustion. We also note, as another suggested cause of climatic change, "the friction and displacement of the air caused by constant locomotion over 20,000 miles of railways," and "in support of this theory," the author

"would cite the comparatively unchanged character of the climate in the north of Scotland, where railways and gas only partially exist, and the humidity and enormous rainfall in Glasgow and neighbourhood, where these influences are largely developed."

We do not know what exceptional weather, or what change in the humidity and rainfall of Glasgow "Observator" desires to explain. If he desires to indicate that the rainfall and humidity of Glasgow have increased *pari passu* with the increased manufacture of gas and the extension of the railways, he should submit evidence to prove it. But we think it more probable that "Observator" possesses that dangerous property, "a little knowledge," and, having evolved out of his inner consciousness the theory as to gas and railways, he has recollected that Glasgow has the reputation of being a wet place, and has put the theory and the fact together, forgetting that to make out his case he ought to prove that the rainfall of Glasgow since (say) 1840, is greater, relatively to the less populous districts of Scotland, than it formerly was. Need we add that the rainfall of Glasgow is less than half that of the vicinity of Loch Katrine, and other places far from either gas works or railways.

Fortunately, very few pages are occupied with this theory, and the rest of the pamphlet is one of the queerest collections we have seen for a long time, and reminds us of the strangely mixed notices which are the result of pasting up a series of cuttings from newspapers. Running down the contents, we may mention—Soap bubbles—Trees and Forests—Schwabe's theory of Sun-spots—Commercial Depression—Candlemas—A Boy's Kite—Dr. Packman's forecasts (By the bye, they seem rather unlucky. We write this Nov. 10th; Dr. Packman forecasted as follows: "Nov. 3, Storms; 7 to 10, Floods." Our impression is that a calmer and drier period than the past ten days has hardly occurred for a twelvemonth; in London there has not been a tenth of an inch of rain)—Dean Alford's Greek Testament—Nebulæ—Protoplasm, &c.

The author is very careless respecting the spelling of names; in the table of contents we have Dawe's, Fitzroy, Symond's, Condomine, Smythe, Baddom, and Rowbottom — but with all its faults the pamphlet is worth its trifling cost.

THE SANITARY INSTITUTE AT CROYDON.

AT the recent autumn meeting of the Sanitary Institute, one of the three days was appropriated to papers upon Meteorology, Geology, and Geography. This was a recognition of the practical bearings of meteorology, of which meteorologists may be somewhat proud, and with the papers contributed, both the writers and their fellow-workers may be quite content. As the section was presided over by Mr. Symons we cannot offer in these pages any remarks upon his address, but it is so rare to find any one pointing out the practical applications of meteorology, that we believe our readers will not object to

the reprinting of those portions of it which bear most closely upon those relations.

ADDRESS BY G. J. SYMONS, F.R.S.,

Secretary Meteorological Society; President of Section III.

* * * * * * *

I, therefore, purpose taking the branches of science mentioned on our programme, and pointing out some of the points of contact between these branches of science and Sanitary practice.

METEOROLOGY.

Let us take, first, temperature. Meteorologists can tell us the range of temperature to which we are liable in this country; but who will point to even one house so constructed as to resist equally well, extremes of heat and of cold? As regards the majority of houses, built solely in order to be sold, it is patent to everyone that this consideration is entirely neglected. The walls are so thin that they allow the internal temperature in summer to run up to eighty degrees or more, and in winter down far below freezing. There is rarely any outlet for the foul and heated air when it has found its way up the staircases; landlords never think of providing outside Venetian blinds, and the rooms which face the sun become veritable heat-traps. Everybody knows that foul and heated air ascends, and yet (owing to the rare adoption of French windows) nineteen-twentieths of all the rooms in England have no outlet within eighteen inches or two feet of the ceiling, where, consequently, there is a permanent stratum of foul and heated air; and, as if with a desire to aggravate this evil, a quantity of gas is burned in the rooms, and the deoxygenized air rises into this stratum, and remains there. Perhaps, if it were possible to compel every builder to remain for an hour with his head close to the ceiling of the rooms he built, an alteration would not be long deferred; unless, indeed, the foul air killed them all. Everybody knows all this, but few, indeed, are the cases in which any attempt is made to remedy the evil.

In cold seasons it is equally discreditable to hear on all sides complaints of the inconveniences arising from frozen water-pipes, and from their leakage when a thaw follows. If the temperature in England ran down to twenty or thirty degrees below zero, there would be some excuse for such occurrences, but our winters are never so severe.

This reminds me of another case in which a little meteorology would have saved several hundred pounds and much inconvenience. An engineer laid out the waterworks of an inland English town, and either from economy or want of experience, he put his mains only one foot below the ground. He made no inquiries as to the temperature of the soil at that depth. A great frost came: the temperature at one foot went below thirty-two degrees, and so large a proportion of his pipes was burst that it was virtually a case of new mains throughout the town.

Another winter accompaniment which has occurred for hundreds of years is always a source of great confusion—I mean a heavy fall of snow. No one seems to know what is to be done, and the last idea is in many respects the worst. The tramway companies introduced the plan of scattering salt in order to dissolve the snow, and the owners of private houses have imitated them by scattering salt on the pathways in front of their houses. The result is, that the pavements are covered with rotten slush of an excessively low temperature, so cold as to lame dogs temporarily when passing over it, as to be injurious even to the well-shod, and almost unbearable to the shoeless wanderer. It would be very little trouble to sweep this soft slush into the gutters, and I think that any one using salt and not removing the resultant slush, should be not only *liable to* a small fine, but should infallibly *be fined*.

* * * * * * *

Excuse this digression, and allow me to return to the more direct relations

of meteorology with Sanitary matters. People of the *cui bono* class are, I believe, yearly becoming more rare, but there are thousands still who would doubt what possible use it could be to know how many miles of wind blew over Greenwich yesterday; and a still larger number would fail to see what possible bearing such a fact could have upon Sanitary matters. Mr. Haviland would tell us that both the direction and strength of the wind ought to be considered in laying out the plan of a town or of large additions to existing ones, and in the past, if not in the present, great care was taken that country residences were protected from objectionable winds by belts of trees. There is, however, a still closer connection, for the members will not have forgotten that this Institute is, and has been for a long time, conducting a series of experiments upon the effectiveness of several patterns of cowls, and that these experiments have been conducted with anemometers and air meters at the Meteorological Observatory at Kew.

Moreeover, questions of ventilation, both for public buildings and especially for hospitals, are almost wholly determined by means of small air meters, which are merely delicate anemometers.

Lastly, it is a rather curious fact that upon the summit of that modern Tower of Babel, the Queen Anne Mansions, Mr. Hankey has put an anemometer. I wish he would put another in the court-yard, and publish the records of both. Joking apart, I hold that if premises are to be carried to that height, the streets must be proportionately wider; for the air in a street of ordinary width, but with buildings of that height on each side, would scarcely ever be changed; its only purification would be by the passage of such portion of the rainfall as escaped falling against the houses. The notion of walking through a future London composed of streets of their present width, and houses as high as Mr. Hankey's, is the reverse of agreeable.

Take, again, ozone. I am not going into the chemical question, nor the strictly meteorological one; but in spite of all the demonstrations of the inutility and inaccuracy of the old-fashioned ozone test-papers, I think that they were giving us more useful information than we seem likely to obtain from the more scientific methods which have been declared to be alone of any use. We want some rough-and-ready test of the purity and healthiness of the air in different localities, but at present I know of none. The old-fashioned ozone test-papers had, doubtless, a multitude of faults—I have attacked them somewhat vigorously myself, and Dr. Cornelius Fox still more so; but unfortunately the arrangement which he proposed to substitute was so elaborate, that at the present moment I do not know of a single place in the whole of the British Isles where it is at work. Faith in the old plan has been shattered, and the new one has not been adopted. Perhaps it may be well to epitomize the old method and its faults, as it may lead some one to suggest a safe and simple course.

And first, as to the method. Sheets of absorbent paper were dipped in a solution of iodide of potassium and starch, dried, cut into small strips, made into bundles, and sold in boxes. Observers were instructed to take one out each morning, hang it up in a place open to the air, but shaded from light and of course from rain, and on the following morning to note the amount of discolouration by comparing it with a series of ten pattern-tints supplied with each box of papers; if there was no discolouration the entry was 0, if the paper was rendered quite a dark brown the entry was 10, and intermediate numbers for intermediate discolourations.

So much for the method; now for the faults. The discolouration is effected by the contact of air with the paper; therefore, if on two days the amount of ozone in the air is the same, but the wind blows twice as strongly on one day as on the other day, it is obvious that the discolouration will also be double. This difficulty can be overcome in two ways—(1), by applying to the observed discolouration a correction corresponding with the total horizontal motion of the wind, as recorded by an anemometer placed near the ozone paper; or (2), by sheltering the test-paper from the wind and drawing a measured volume of air over the paper by an aspirator. The papers after exposure and colouration may, by the action of antozone or damp, be bleached before the usual hour of

observation, and whereas 7 may have been reached some hours previously at the regular observation hour the paper may only show 0 or 1. The late Dr. Lankester proposed to get over this difficulty, and also to determine the variation in the amount of ozone during the twenty-four hours, by using the paper in long strips, and winding it by clockwork from one drum to another under a small aperture. I do not think that he arranged his machinery with an intermittent motion, so that each portion should be exposed for some definite period—say, an hour, and then suddenly replaced by another portion, and so on, but that would obviously be the proper course.

There are many other imperfections charged against the old plan; but I will mention only two others. The papers were said not to be equally sensitive, and therefore the recorded discolourations were not strictly comparable. I believe that this ground of complaint arose chiefly from the very limited demand for the papers, and from the fact that there were was so much jealousy among the opticians that, instead of all buying from one source, each tried to make his own. I have left the most serious charge to the last. Chemists of high position said that there was no certainty that the discolouration was in the least degree due to ozone, and, I believe, proved their case by tinting the papers by half-a-dozen processes when no ozone was present. Perhaps, however, we shall find that the papers give us useful information, even if they tell us nothing about ozone.

In this, as well as other countries, the public attention given to scientific work is not proportional solely to the merit of the work, but is dependent on two factors: A, the social and scientific status of the worker; and B, the merit of the work. Meetings like the present tend greatly to dimini h the value of the factor A, and I sincerely hope that before long it will vanish entirely, and leave the factor B, the merit of the work, as its sole credential. You may wonder at the insertion of this digression; but it was induced by my having resolved on now mentioning, for the first time, a few experiments which I made nearly five-and-twenty years ago.

I arranged with friends residing in various parts of the metropolis—one in the City, one at Whitehall, others at Chelsea, Notting Hill, Blackheath, Camden Town, and Camberwell—for three months' continuous observations of the amount of ozone. We took all the steps that we could to secure uniformity, even taking the precaution of cutting each ozone slip into portions, so that all the stations used the same slip on the same day. At the end of the month the portions were returned to me and mounted as one slip for each day. That they in the least indicated the amount of ozone I am not going to assert; but this I can safely say, that no matter from what direction the wind blew, the papers in that quadrant of the metropolis first reached by the wind were always more darkly tinted than those in the centre or in the opposite quadrant: those at the central stations were scarcely ever tinted. Similar results were, I believe, obtained by Mr. Glaisher during the cholera epidemic in 1854, and though no special arrangements were made to ensure identity of paper, I do not think that the accuracy of the results was thereby vitiated. These very simple and inexpensive tests may be beneath the contempt of the optimists of ozone observers, but they at least prove that there is some quality in air coming from the country to the metropolis which is extracted, not only before passing over the whole of London, but even before passing over half of it, otherwise the central stations must sometimes have recorded traces of discolouration.

That there is a wide difference in the healthiness of different localities is indisputable, and that there is more in it than is revealed by either barometers, thermometers, hygrometers, rain gauges or weathercocks, is equally certain. Something may be learned by the chemical analysis of large volumes of air; something, indeed a good deal, is being learned at Paris by drawing a stream of air over glycerine and examining miscroscopically the particles of dust deposited. But we want something more handy. It is too bad that there should be no easy means of determining the relative life-supporting properties of the air in Hyde Park and Seven Dials. I do not for a moment say that the old-fashioned ozone papers will do it, but they are the nearest approach which

has yet been made, and I should be very glad if they can be supplanted by something better.

Mists and Miasma.—Before proceeding to consider mists in their relation to public health, I take one moment to say that if any of my hearers have ever seen in this country the presiding genius of mists—I mean the *ignis fatuus*, or "Will o' the Wisp," I shall be greatly obliged by their favouring me with full particulars. I only make this request because, in the course of long search, I have not met with one person who has seen it; and I am sure that, especially after the present soaking season, drainage operations will proceed so rapidly that future opportunities will be rare indeed.

Here, however, we are concerned with mists and their influence upon health. You, doubtless, remember the remark of the country doctor, who, walking up a hill, passed from the valley mist into the clear air on the hill-side, and turning to his companion, remarked that that white sheet covered all his best patients. I wish we had statistics of the mortality in some of our old monasteries—Fountains, Tintern, or Rievaulx—for the localities are equally noticeable for their beauty and their mists; and although the regularity of the monastic life might conduce to longevity, I should have thought such damp localities very ill-adapted for such residents. It is often suggested that our ancestors were stronger than we are, and that, as much of their time was spent in the open air and in hunting, they were less susceptible to the Sanitary evils of their houses and castles. But the monks, even those who were not actually studious, did not lead by any means an equally active, open-air life. Were they, then, able to throw off the effects of damps and mists, or did they fall victims to them without knowing the cause? We, however, with all our nineteenth-century artificial and high-pressure life, know perfectly well that a "lovely spot embosomed in trees and encircled by hills" is usually characterized by a damp, misty, cold, and stagnant atmosphere. We know that these conditions are not adapted for vigorous health; and yet how many persons will rush blindfold into the arms of the doctor, simply for the sake of a pretty view! Persons generally select residences, and the sites for new ones, when the weather is fine and the sun shining. There is no reason for their discontinuing the practice; but many selections would, I think, be abandoned, if they would spend an hour or two of the twilight and night in examining the distribution of the mists in the locality. When we remember that few persons spend less than half their time indoors, it is surely not asking very much to urge than an hour or two should be devoted to examining roughly the conditions of the air which will in future surround them for half their lives.

You may think that I attach undue importance to mists, and I will, therefore, give you a short chapter of personal history. A relative had a great desire to spend his autumn holiday in a beautiful, hilly, and well-wooded part part of England. Unable to obtain quarters on the high ground, he was induced to take a very clean little cottage on low ground; not, however, very near the river which ran through the little town. At first, four of the family went down, and three of them were speedily attacked with diarrhœa; another relative followed, and was similarly attacked; and finally I arrived myself. I was told of the state of affairs, and advised not to touch the water—on which all the blame was laid. The last train had left; and, moreover, I felt desirous of investigating the case. After dark we went out for a little stroll, and found the air excessively damp; in fact, there was a white sheet over the whole place. Next morning, I was as ill as the rest of the party. I had with me some permanganate of potash, and tested the water from two or three sources with it; but the colour remained absolutely unchanged; so I suppose there was not much the matter with the water. One of the party started off after a doctor; the doctor was out, but the assistant said directly, "Oh, no; it is not the water; strangers are almost always attacked like that; but they soon get better, or else they go away. You see," he added, "this valley is supposed to have been under sea water not long ago, and all the fields from here to the coast are terribly misty and agueish." I need hardly add that it was not many hours before the whole party migrated to a high

dry and sandy soil; but it was only by sleeping in the locality that the evil was incurred, and had we only seen the spot by day-light, scarcely a suspicion of evil would have crossed anyone's mind.

Closely connected with the existence of mists is the amount of evaporation, —a subject upon which we are in nearly the same unsatisfactory condition as I have explained to exist respecting ozone. Some very elaborate, rather costly, and I believe extremely important observations upon this subject, were commenced more than ten years since, and have been conducted under the supervision of Mr. Rogers Field. We are still waiting for his full report on the subject, but it is understood that all the old forms of evaporator are useless, and no new pattern has been introduced in their place. The only two points of contact between evaporation data and sanitary work which occur to me are —(1), that evaporation data would be serviceable in computing the yield of storage reservoirs, a point upon which I believe no information is published, and not much exists; (2), data as to the amount of evaporation would be very useful in connection with sewage irrigation, for it ought evidently to be most successful where the air absorbs the largest amount of surplus moisture.

Hygrometry is almost identical with the measurement of evaporation, but not quite; because hygrometry considers the amount of moisture in the air at rest, and evaporation is the resultant of the passage of a variable number of miles of air of a variable hygrometric condition over a water surface. I am afraid this point is hardly clear: I will therefore put it in another form. The air we breathe is, you know, a compound; there is first an approximately constant quantity of oxygen, hydrogen, &c., and secondly a very variable quantity of water in the invisible state of vapour. It is the business of hygrometers to tell us how much water there is in the air. It is never very great, fifteen grains of water in a cubic foot of air is the extreme, perahps a trifle beyond the extreme, which ever occurs in this country, while it may run down to one grain per cubic foot. The hotter the air is, the more water can it contain, and hence the high temperature always given to drying-rooms; and hence it follows that though a room may be dry while it is kept at a high temperature, it will very likely become damp when the temperature falls. A striking illustration of this is reported to have occurred at a ball in Russia. The night was cloudless and very cold, but the room in which the ball was being held was, as is usual in that country, close and hot. A lady fainted; and as fresh air could not easily be obtained, the windows being frozen fast, an officer broke the glass with his sword. The clear cold air rushed into the room and cooled that inside so rapidly, that the vapour became mist, the mist became frozen, and snow was formed in the room.

Some people err the other way, and especially in cases of illness, distress the invalids, and check their recovery by allowing the air to become too dry. I suppose matters may change in the next generation, but at present either a doctor or a nurse would be considered a pedant who used a hygrometer in order to regulate the air breathed by a patient. I am glad to see that we are progressing in that respect. Two generations back the subject of the hygrometry of the sick-room was unknown. Twenty years ago a paper spout on the nozzle of a tea-kettle was the most advanced apparatus, and now we have got as far as regular vaporizers; but I have not heard of any general demand for hygrometers to indicate when, and to what extent, vaporizers are to be used, and I fear that much is still left to the personal sensations of the medical attendant and the nurse, although it is just as easy to order what shall be the hygrometric state of the sick room, as what shall be its temperature, and I think it probable that in many affections of the respiratory organs, the former is of more consequence than the latter.

There is another matter in which hygrometry ought to come home to many, especially at a period when people seem so prone to forsake old and comfortable houses for new and showy ones. Almost before a house is finished, and long before the water necessarily used in its construction has had time to dry out, people rush in to reside, and then there are rumours of colds, rheumatics, &c., as if anything else could be expected in such a climate as that of the

British Isles. I am not going to show how the hygrometer would enable people to adopt this course with impunity, but there are many ways in which it would teach them what to do, and what not to do.

* * * * * * *

(To be Continued.)

SUPPLEMENTARY TABLE OF RAINFALL IN OCT., 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	·61	XI.	Port Madoc	3·00
,,	Littlehampton	1·23	,,	Douglas	1·40
,,	Dorking, Abinger	·85	XII.	Carsphairn	2·41
,,	Hastings, Manor House	1·11	,,	Melrose, Abbey Gate ...	1·89
,,	Hailsham	·88	XIV.	Douglas Cas., Newmains	1·86
,,	I. of W., St. Lawrence.	1·11	XV.	Islay, Gruinart School..	2·88
,,	Strathfield Turgiss	·77	XVI.	St. Andrew's, Cambo ...	...
III.	Great Missenden	·96	,,	Aberfeldy H.R.S.	1·55
,,	Winslow, Addington ...	·76	XVII.	Tomintoul	2·08
,,	Oxford, Magdalen Col...	·94	,,	Keith H.R.S.	1·45
,,	Northampton	·46	,,	Forres H.R.S.	·91
,,	Cambridge, Merton Vil.	·69	XVIII.	Strome Ferry H.R.S....	4·14
IV.	Harlow, Sheering	·85	,,	Lochbroom	3·84
,,	Diss	·80	,,	Auchnasheen H.R.S. ...	...
,,	Swaffham	1·15	,,	Tain, Springfield	1·41
,,	Hindringham	1·85	,,	Loch Shiel, Glenfinnan.	7·93
V.	Salisbury, Alderbury ...	·72	,,	Dalwhinnie H.R.S.....	...
,,	Calne, Compton Bassett	1·11	XIX.	Lairg H.R.S.	2·03
,,	Beaminster Vicarage ...	2·19	,,	Altnabreac H.R.S.	·60
,,	Dartmoor Prison	...	,,	Watten H.R.S.	2·51
,,	Langtree Wick	1·84	XX.	Fermoy, Glenville	1·02
,,	Lynmouth, Glenthorne.	2·55	,,	Tralee, Castlemorris ...	2·01
,,	St. Austell, Cosgarne...	2·04	,,	Cahir, Tubrid	1·02
,,	Taunton	1·16	,,	Tipperary, Henry St....	1·48
VI.	Bristol, Ashleydown ...	1·63	,,	Newcastle West	1·45
,,	Wem, Sansaw Hall.....	1·29	,,	Kilrush	1·99
,,	Cheadle, The Heath Ho.	1·27	,,	Corofin	2·64
,,	Bickenhill Vicarage ...	·87	XXI.	Kilkenny, Butler House	·91
VII.	Melton Mowbray	·75	,,	Carlow, Browne's Hill..	·84
,,	Horncastle, Bucknall ...	1·27	,,	Kilsallaghan	1·43
VIII.	Walton-on-the-Hill.....	1·13	,,	Navan, Balrath	·99
,,	Broughton-in-Furness ..	3·95	,,	Athlone, Twyford	1·90
IX.	Wakefield, Stanley Vic.	·86	,,	Mullingar, Belvedere ...	1·41
,,	Ripon, Mickley	1·04	XXII.	Ballinasloe	1·47
X.	Gainford	·61	,,	Clifden, Kylemore	5·61
,,	Haltwhistle, Unthank..	1·77	,,	Crossmolina, Enniscoe..	2·88
,,	Shap, Copy Hill	1·85	,,	Carrick-on-Shannon ...	1·94
XI.	Llanfrechfa Grange	1·12	,,	Dowra	3·10
,,	Llandovery	2·84	XXIII.	Rockcorry	2·11
,,	Solva	1·75	,,	Warrenpoint	1·47
,,	Castle Malgwyn	1·43	,,	Newtownards	1·10
,,	Rhayader, Nantgwillt..	2·80	,,	Larne, Carnlough	1·77
,,	Carno, Tybritle	2·36	,,	Bushmills	1·44
,,	Corwen, Rhug	1·69	,,	Buncrana, Rockfort ...	2·49

OCTOBER, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	·80	— 1·70	·33	19	9	67·4	4	33·4	26	0	4
II.		Maidstone (Hunton Court)	·40	— 2.59	·12	24	11	...	...	...	...	...	...
,,		Selborne (The Wakes)	·98	— 3·23	·15	19	13	63·0	6	28·0	26	2	5
III.		Hitchen	·61	— 1·94	·24	24	12	60·0	1	29·0	15	2	...
,,		Banbury	·68	— 1·75	·12	19	13	63·5	4	31·5	16	1	...
IV.		Bury St. Edmunds (Culford)	1·11	— 1·60	·32	19	11	65·0	6	29·0	25	4	9
,,		Norwich (Cossey)	1·37	— ·97	·30	2	18	65·0	5	32·0	26	1	2
V.		Bridport	1·36	— 2·67	·59	25	8	...	...	...	...	...	...
,,		Barnstaple	2·47	— 1·65	·74	18	13	70·0	8	32·0	16	1	...
,,		Bodmin	2·69	— 2·63	·82	25	15	59·0	7	33·0	16	0	1
VI.		Cirencester	·88	— 2·61	·18	24	9	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	1·42	— ·82	·36	24	12	61·0	1	27·0	16	3	4
,,		Tenbury (Orleton)	1·07	— 2·16	·21	24	12	65·0	4	27·3	16	2	3
VII.		Leicester (Town Museum)	·91	...	·30	2	15	64·0	6	33·0	16	0	10
,,		Boston	·71	— 1·41	·18	1	11	65·0	6	33·0	16	0	...
,,		Grimsby (Killingholme)	·97	...	·24	1	13	60·0	1, 24	33·0	26	0	...
,,		Mansfield	·98	...	·19	14	13	62·9	1	28·7	26	1	...
VIII.		Manchester (Ardwick)	2·67	— ·86	·58	20	15	59·0	1*	31·0	16	1	...
IX.		York	·82	— 1·70	·31	14	16	66·0	5,6	29·5	26	2	6
,,		Skipton (Arncliffe)	4·31	— 2·35	1·71	3	17	66·0	5	29·0	25	6	...
X.		North Shields	·69	— 2·59	·30	14	17	59·2	23	31·4	26	2	...
,,		Borrowdale (Seathwaite)	8·03	— 8·29	3·51	3	15	...	...	...	...	..	...
XI.	WALES.	Cardiff	1·51	...	·35	19	12	63·5	6	30·4	16	1	...
,,		Haverfordwest	2·27	— 2·92	·60	25	9	63·0	6	37·0	25	0	...
,,		Lampeter (St. David's Coll.)	...	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	1·63	— 2·33	·33	24	11	61·3	6	48·0	15	0	...
XII.	SCOTLAND.	Cargen	1·73	— 3·75	·42	22	11	63·4	5	28·8	15	3	...
,,		Hawick (Silverbut Hall)	1·06	...	·31	19	10	...	...	...	...	...	...
XIV.		Annanhill	2·26	...	·89	23	14	60·4	6	25·0	15	4	8
XVI.		Kilmory	3·67	...	1·02	18	18	...	...	26·0	15	5	...
,,		Mull (Quinish)	4·06	...	·66	18	19	...	...	...	...	...	...
,,		Loch Leven	1·40	— 3·58	·30	19+	8	...	...	...	...	...	...
,,		Loch Long (Arddaroch)	4·86	...	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	·70	— 2·99	·19	18	7	62·0	10	32·0	26,28	2	...
,,		Braemar	1·27	— 1·48	·24	19	12	68·5	7	21·5	27	13	22
XVIII		Aberdeen	1·20	...	·43	18	18	61·2	10	30·1	27	3	13
,,		Portree	5·17	— 5·61	1·18	18	20	...	...	...	...	...	...
,,		Inverness (Culloden)	1·23	— 1·43	...	...	...	61·6	6	28·5	27	2	15
XIX.		Dunrobin	2·15	— 1·08	·34	13	17	60·5	8	30·0	28	2	...
,,		Sandwick	3·40	— 1·52	·57	18	23	54·9	5	43·4	17	0	4
XX.	IRELAND.	Caherciveen Darrynane Abbey	2·07	...	·30	18	15	...	...	...	...	...	...
,,		Cork	...	...	...	...	...	...	...	...	...	...	...
,,		Waterford	...	...	...	...	...	...	...	...	...	...	...
,,		Killaloe	2·35	— 2·67	·71	18	13	69·0	5	29·0	26	3	...
XXI.		Portarlington	1·43	— 3·71	·43	18	23	63·0	3	31·0	25	1	...
,,		Monkstown, Dublin	1·11	— 2·81	·40	25	13	...	...	...	...	...	...
XXII.		Galway	2·30	...	·59	18	15	65·0	7	33·0	25,26	0	...
XXIII		Waringstown	1·32	...	·28	19	14	64·0	5	32·0	28	1	3
,,		Edenfel (Omagh)	2·10	...	·57	19	20	62·0	7	28·0	25	2	...
,,		Ballinfull	...	...	...	...	...	...	...	...	...	...	...

* And 5, 6. † And 24.

\+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON OCTOBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

SELBORNE.—North-east wind prevailed during the dry part of the month, and, consequently, the farmers have had a most promising seed time.

HITCHEN.—A very cold, dry, dull, and sunless month. Harvest still not completed. Mean temp. considerably below the average of 30 years.

CULFORD.—Mean temp. 48°·3; not below the average. Polar winds prevailed during ten days. The weather, during the early part of the month, was very favourable. Swallows were last seen on the 16th. H on 15th.

BODMIN.—Mean temp. of the month 54°·1.

CIRENCESTER.—A dry month. E. and N.E. winds prevalent towards the end.

SHIFNAL.—Harvest was not completed till the middle of the month. Grain not much injured, but yield sadly deficient. Fog or mist daily, from 5th to 14th, with high bar. Damsons ripe at last, and an immense crop; apples almost a failure; pears abundant, but many spoilt by cracking. A peacock butterfly at last seen on 4th, but not one red admiral seen this summer.

ORLETON.—The amount of rainfall was smaller than in any month of October since 1842. The weather was generally cloudy, damp, and foggy, with very little sunlight, but yet it was favourable for securing the late harvest. The mean temp. was about 0°·¼ below the average, but there were only three frosty mornings. Distant T on 24th.

BOSTON.—Mean temp. of the month 2° above the average. A great deal of foggy, dull weather. Harvest for white corn finished about the middle of the month, but beans not all carried at the end. Slight fall of S on 15th.

GRIMSBY.—A fine, dry month for gathering the harvest, but both the quantity and quality of the grain were sadly deficient. Short crop of apples and pears. Turnips very small on the clay land.

MANCHESTER.—The early part of the month was wet, followed by a period of dry weather; then, about the middle of the month, it was wet, and rather stormy. Dry weather set in again on 26th, with fogs in the mornings and nights.

YORK.—Though a month of little rainfall, it was not very dry, owing to the mists and drizzle; more sunshine, however, than in previous months. Fine parhelia, at 3 p.m., on 20th.

NORTH SHIELDS.—S and H on 14th and 15th.

WALES.

HAVERFORDWEST.—Windy and stormy for the first four days, after which a period of calm, fine, bright weather set in, but with fogs of the densest and wettest description at night; wind easterly. From the 19th to the 25th, broken weather, with considerable rainfall; from thence to the end fine, serene, cool weather, mostly cloudy. High bar. throughout. The finest and driest October for many years, and certainly the finest month of the present year. Late harvest well saved.

LLANDUDNO.—A dry month. Polar winds prevailed on 20 days, and hence an unusual amount of haze and fog. Mean temp. about 1°·5 below average.

SCOTLAND.

CARGEN.—Mean temp. of month 48°·2; 0°·5 below the average.

HAWICK.—A very fine, mild October, which enabled the farmers to harvest their crops in good order. Green peas were gathered daily up to the 25th.

QUINISH.—A fine month on the whole, with a very unusual amount of calm

and fog. Harvest completed on the 16th. Slight hoar frost from 25th to 29th. Wind from W. to N.W. the whole month.

ARBROATH.—The rainfall is the smallest amount registered in October for 37 years; in October, 1844, the fall was 1·10 in.

BRAEMAR.—As fine a harvest month as could be desired. Crops all secured.

ABERDEEN.—A fine, dry month, though, at times, cold. Mean temp. 46°·0; 0°·5 below the average of 22 years. Rainfall 1·99 in. below mean of the same period. H on 14th, 15th, and 20th.

PORTREE.—Crops not secured here as yet, and no potatoes lifted. Grass still abundant on the hill pastures.

CULLODEN.—Weather, during the month, very fine. Crops gathered in good condition; bulk above average, but yield not promising. Dahlias and other tender plants in full flower, till cut down by the frost in the last week of the month.

SANDWICK.—October is generally our wettest month, and this October is no exception to the rule, but though the rainfall has been more than in any previous month of this year, it is 1·32 in. less than the mean of 38 years; there were, however, a great number of wet days. The weather was such as to allow the grain crops to be taken in, but some potatoes are still in the ground. There was strong wind of 45 miles an hour on 1st, and of 40 miles on 3rd, 4th, and 13th, but no storm. Large lunar halos on 27th and 29th.

IRELAND.

DARRYNANE ABBEY.—A fine month, with northerly and easterly winds, and very calm sea. The driest October for ten years.

KILLALOE.—Generally overcast, and little sunshine, but very good and useful weather for finishing up harvest work.

MONKSTOWN.—The driest October since 1869; the only rainfall of any account being on the night of the 25th, accompanied by T and H. The bar. was unusually high from the 7th to 13th, during all which time dense fog prevailed. Frost occurred, for the first time this season, on the morning of the 15th.

WARINGSTOWN.—On the whole a very fine month, the last week in particular being most opportune, enabling the great bulk of the grain crops in this district to be safely stacked.

OMAGH.—The finest and mildest month of the year. A heavy, though late, cereal harvest well saved.

TWO QUERIES RESPECTING LIGHTNING.

To the Editor of the Meteorological Magazine.

SIR,—In your September issue, in a report from Cambridge on the TSS of August 2-3, I see it stated that 120 flashes of L per minute were observed (p. 126). In other reports the L, both sheet and forked, is described (p. 126) as incessant, and (p. 128) 33 flashes per minute are recorded.

Am I right in assuming that the so-called sheet L is merely the reflection of forked L; and, if so, may not one flash of the latter produce many reflections from cloud to cloud, so as to appear to light up the sky in different parts by a series of almost continuous reflected flashes? May I also ask whether any explanation has been given of the variety of colour of L?—Yours very truly,

H. GEORGE FORDHAM.

Odsey Grange, Royston, 21st Sept. 1879.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLXVII.] DECEMBER, 1879. [PRICE FOURPENCE. or 5s. per ann. post free.

METEOROLOGY IN PORTUGAL.*

OUR notice of the present state of meteorology in Portugal naturally divides into two parts—(1) Places and methods of observation; (2) Results.

The chief observatory, that of the Infante D. Luiz, at Lisbonne, is about a mile from the Tagus, and 300 feet above the sea, and is under the personal direction of Senor J. C. de Brito Capello. It is provided with photographically recording barometer and hygrometer, with two recording anemometers (one a Robinson for velocity, and the other a Cator for pressure), also with a recording rain gauge on the top of the observatory, of which we should be glad to receive a detailed description. There is also a Thomson's photographic electrometer, a set of magnetographs, and a full set of ordinary meteorological instruments. There appears, however, to be one omission: we do not see mention of any thermometers for observing the temperature of the earth at different depths. We trust that a set for this purpose will soon be added.

The second-order stations are—

COAST.

Porto..... Lat. 41°8′ N., Lon. 8°37′ W., Altitude 279 ft.
Lagos..... Lat. 37°8′ N., Lon. 8°48′ W., Altitude 43 ft.

INLAND.

Guarda..... Lat. 40°32′ N., Lon. 7°20′ W., Altitude 3409 ft.
Campo Maior. Lat. 39° 2′ N., Lon. 6°56′ W., Altitude 945 ft.
Evora..... Lat. 38°40′ N., Lon. 7°39′ W., Altitude 1027 ft.

Each of these stations is provided with standard barometer, hygrometer, max. and min. thermometer, rain gauge, evaporimeter, Robinson's anemometer and ozone papers. (Similarly equipped sta-

* *Résumé Météorologique du Portugal.* Par M. DE BRITO CAPELLO. Large 8vo. 1879.

La Pluie à Lisbonne. Par M. DE BRITO CAPELLO. Large 8vo. 1879.

Pression Atmosphérique à Lisbonne, 1856-75. Par M. DE BRITO CAPELLO. Large 8vo. 1879.

Détermination de la Température de l'Air. Par M. DE BRITO CAPELLO. Large 8vo. 1879.

Postos Meteorologicos, 1876. SEGUNDO SEMESTRE. Folio. 1878.

Annaes do Observatorio do Infante D. Luiz. VIGESIMO TERCEIRO ANNO. Folio. 1878.

tions are maintained by the Portuguese Government in Madeira, and at St. Thomas, Gulf of Guinea.)

Observations are made at all stations at 9 a.m., noon, and 3 p.m., and at some of them a 9 p.m. observation is added. The observations are printed very fully, almost *in extenso*, in the Postos Meteorologicos.

The results will be most handily given in the form of a table.

Stations.	Altitude	Pressure.		Temperature.					Rain.
		Mean at Sea Level.	Mean diff. 9 am-3 pm	Absolute Max.	Absolute Min.	Mean Max.	Mean Min.	Mean.	
	ft.	in.	in.	°	°	°	°	°	in.
Porto	279	30·013	·029	99·3	30·6	67·6	52·7	60·2	59·96
Guarda	3409	30·071	·007	94·3	19·2	58·0	45·2	51·6	39·34
Campo Maior..	945	30·069	·047	111·7	25·5	73·9	50·8	61·3*	21·81
Lisbonne	335	30·050	·039	100·0	29·3	66·6	55·2	60·9	30·04
Lagos.....	43	30·063	·028	100·9	32·7	71·3	55·5	63·4	23·03

We may translate a few sentences respecting temperature as a comment upon the above table :—

"The mean annual temperature at the three coast stations decreases from south to north, in accordance with the general law.

"At the two stations in the interior great anomalies result from their orographical and topographical position.

"At Guarda (altitude 3,409 ft.), in lat. 40½ N., the mean annual temperature is nearly identical with that of Paris, and, what is still more singular, the mean temperatures of the various seasons, and even those of the various months, are very much like those of Paris.

"The decrease of mean temperature with altitude is about 1° F. for 329 feet.

"At Campo Maior, although in a latitude slightly north of Lisbonne, and at an altitude of 945 feet, the mean temperature exceeds that of Lisbonne.

"This anomaly is entirely due to its inland position. [It is near Badajoz, and about 116 miles from the coast.]

"Campo Maior is in a district which is very dry, and consequently greatly heated during the summer.

"There are there, during summer, periods of ten and fifteen consecutive days with the temperature at 9 a.m. exceeding 86°, and during this period daily maxima often exceeding 108°.

"On the coast during the warm season there is almost always a sea breeze, beginning between 11 a.m. and noon. Although on many occasions this breeze is feeble and of short duration, it always lowers the temperature and increases the humidity. But this cooling and softening influence never reaches the inland stations."

The following table gives the monthly rainfall on the mean of the nine years 1864–1872.

* The mean of the max. and min. gives 62°·3, but a correction varying from 0°·5 to 1°·3 has been applied, for some reason not stated by Señor Capello.

Mean Rainfall in Portugal, 1864–72.

MONTHS.	PORTO.	GUARDA.	CAMPO MAIOR.	LISBONNE.	LAGOS.
	in.	in.	in.	in.	in.
January ...	9·49	5·00	2·60	4·14	3·18
February ...	5·07	3·40	2·28	3·21	2·74
March	5·98	4·69	2·40	3·69	3·57
April.....	3·42	2·67	1·42	1·63	·80
May	5·04	4·30	2·25	2·53	1·84
June.....	1·43	1·43	1·06	·39	·45
July	·94	·60	·13	·14	·00
August.....	·87	1·04	·58	·32	·18
September .	5·12	3·10	1·78	1·93	1·28
October ...	6·85	4·68	2·40	3·54	1·70
November .	8·66	4·38	2 67	4·12	3·66
December ..	7·09	4·05	2·45	4·40	3·63
TOTAL ...	59·96	39·34	22·02*	30·04	23·03

We are rather surprised at the number of fogs. There being on an average 67½ days in a year with fog at Guarda is not remarkable considering the elevation, but that there should be 19 at Lisbonne, and 37½ at Porto, does seem excessive. Thunder is very rare at Porto; on an average it is only heard on three days in a year.

The observations of rainfall at Lisbonne scarcely seem as good as those of other meteorological elements.

There are now two rain gauges at the observatory—one, which was erected about 20 years since, on the top of the observatory, 75 ft. above the ground, and the other 5 ft. above the ground; but they collect nearly identical amounts. This is such an unusual fact that we should be glad to know whether the lower gauge is quite fully exposed. We have not been able to find any statement upon this point.

The earliest observations quoted in the works before us are some made by M. Franzini, respecting the diameter, height and position of whose gauge not a word is said; information on these points would double the value of the observations. However, we convert and give here the annual totals :—

RAIN AT LISBONNE.

According to M. Franzini.				*According to gauge on roof of the Observatory of the Infante D. Luiz.*	
	in.		in.		in.
1836.....	15·83	1846.....	29·25	1856..... 34·65	1866..... 25·10
7.....	13·54	7.....	25·51	7 ..... 29·85	7..... 26·31
8.. ...	34·57	8.....	21·54	8..... 37·40	8 ..... 26·38
9.....	22·05	9.....	20·24	9 .. .. 27·60	9..... 18·87
1840.....	21·14	1850.....	19·17	1860..... 28·23	1870..... 24·86
1	29·45	1.....	19·41	1..... 32·17	1..... 36·12
2.....	21·38	2.....	30·75	2..... 32·93	2..... 36·50
3.....	23·98	3.....	30·08	3..... 18·95	3..... 27·34
4.	30·59	4.....	18·19	4..... 37·42	4..... 17·22
5.....	32·17	5.....	51·02	5 ..... 38·82	5..... 18·33
	24·47		26·52	31·80	25·70
Mean of 20 years = 25·50 inches.				Mean of 20 years = 28·75 inches.	

* There is an error of 6 mm. either in the months of Dec., Jan. or Feb., or in the total given on the previous page, and there is no means of ascertaining which is correct.

AN ANTICIPATION FULFILLED.

To the Editor of the Meteorological Magazine.

SIR,—On May 4th I addressed you as follows:—"I cannot get at any satisfactory data for supporting my theory, that cold winters are followed by cold summers;" but, at all events, my theory has been justified by the Arctic temperature of the past summer six months, which read as follows:—

May.....	46°·5	.....	only two colder in 30 years.
June	54°·9	.....	only one ,, ,, ,,
July.....	56°·5	.....	only one ,, ,, ,,
August	57°·6	.....	only three ,, ,, ,,
September ...	52°·8	.....	only four ,, ,, ,,
October	46°·2	.....	only six ,, ,, ,,

Average of six months, 52°·3.
Do. of do. 30 years, 55°·1.

The month ended yesterday was colder than the same month last year, and there have been only three colder in the last 30 years. I fear we are in for a frightful winter, the only hopeful sign at present is the absence of fieldfares, which are generally harbingers of cold, and of which I have seen none.

Yours truly,

W. LUCAS.

Hitchen, 1st Dec., 1879.

THE FROST OF 1795.

To the Editor of the Meteorological Magazine.

SIR,—I send you a very curious extract from the diary of Margaret Woods, which has lately been brought to my notice. My mother, who knew about Mrs. Woods, stated that she lived after 1795 at Stoke Newington, and that if she was not living there in 1795 she was certainly living within a few miles of London, where her husband was in business.

"On the 25th January, 1795, the thermometer was only $2\frac{1}{2}^{\circ}$ out of doors, and on the 27th of the same 43° out of doors. A rapid thaw had taken place in the preceding night, and the difference of climate within and without doors was so remarkable, that the rain and melted snow which overflowed the gutters and ran through the ceilings, froze as it ran down the bed curtains and formed icicles at the bottom, and cakes of ice on the floor; neither of which completely thawed till after the admission of outward air in the morning: the following day it froze again."—*Diary of Margaret Woods.*

Yours very truly,

ROGERS FIELD.

5, *Cannon Row, Westminster, S. W.*
20th November, 1879.

[The above reading of 2°·5 on January 25th, 1795, agrees very well with what might have been expected for the neighbourhood of

Stoke Newington, which at that date was a country village. The following list of temperatures for that day may be of interest: it must be remembered that few minimum thermometers were in use. Most of the following are 8 a.m. temperatures.

LONDON.—Paternoster Row.—Thermometer, outside a window 15 ft. above ground facing N., was 12°; but outside an attic window (? 40 ft. above ground) it was 9°.
„ Somerset House, Strand. 7°.
„ Norfolk Street, Strand. 7°.
„ Beaumont Street, Marylebone. 4°.
SOUTH LAMBETH. 0°.
„ „ .—4°.
CLAPHAM.—6°.
EDMONTON.—1°.
ST. ALBAN'S. 5°.
MANSFIELD, NOTTINGHAMSHIRE. 12°.
MAIDSTONE.—On a post 5 feet above the snow, —10°; on the snow, —14°.—ED.]

THE WEATHER IN NOVEMBER.

LITTLE change from the weather which had prevailed during the last few days of October was experienced during the first seven days of this month. During the greater part of the period pressure increased and readings became uniform and unusually high in the western part of W. Europe, while the lowest bar. was found in Scandinavia. N. to N.W. winds consequently prevailed over these Islands, and N.E. winds in France, while the weather was cloudy but fair and dry; temperature, however, was nowhere low. On the evening of the 7th the change began, the bar. began to fall everywhere, most in the west, and the area of high readings moved eastward over England and Central Europe, so that while very light breezes blew in the south-east, S. winds began in the west, the weather becoming dull and misty.

Conditions very different from the above were experienced during the week following. On the 9th a large anticyclone lay over the south-eastern part of W. Europe, and a large depression lay to the northward of Scotland, so that breezes from S.W. to W. prevailed, with cloudy, mild weather. Next day an area of high readings was developing in the west, and the wind veered to N. with fair weather and rather low temp. On the following day, however, a brisk decrease of pressure had occurred in the north, the anticyclone was shewn over the Channel and France, and W. breezes blew generally; temp., however, shewing a fall, except in the north. During the day a rather deep depression passed east-south-eastwards over our northern coast, and N.W. gales were experienced in some districts.

The centre of the depression had reached Denmark by the 12th, and N. winds and gales prevailed in these Islands, the weather being fair and cold. On the 13th the bar. had risen quickly, and a large area of high pressure lay over our west coast and the north of France, and N. breezes with a further decrease of temp. were reported. On the 14th and 15th pressure was highest over the north of Scandinavia, but a band of high readings stretched in a southerly direction across the North Sea and these Islands to the north of France. Within this band light airs with sharp frost and fair, but misty or foggy, weather prevailed, while N. breezes were reported over and to the eastward of the North Sea, with S. winds and warm cloudy weather on our western coast.

Important changes occurred in the weather during the next week. At first a large area of high pressure lay over the south of England and the greater part of France, while a low bar. was reported from our northern coasts and over the Baltic. These conditions, with some modifications, held good during the 16th and 17th, so that while S.W. to W. breezes prevailed, with moderately high temp., in the west and north, but sharp frost in the south on the 16th, which was, however, immediately followed by mild weather on the 17th. On the 18th the highest pressures were reported from our south-western coast, but a second area of high readings was in course of formation over the Baltic, and during the day a broad band of high pressure was developed, extending from the west coast of these Islands as far as Sweden, the weather over these Islands being fine and warm, with breezes from N.W.

On the 19th a brisk fall of the bar. occurred in France, while the high pressures were firmly established over Scandinavia, the North Sea, and Scotland, so that E. breezes became general. During the whole of that day and until the evening of the 21st the bar. fell over France and these Islands, while it rose for some time over Scandinavia; consequently steep gradients were formed, the E. wind increased in strength to a gale on some coasts, and the weather became snowy, cold, and most inclement. On the 21st a well-marked depression was shown over England, but on the 22nd, when this disturbance was moving slowly northwards, the bar. rose over S. England, the wind shifted to S, the snow ceased, and the weather improved.

The weather during the remainder of the month was either unsettled or variable, mostly the former. On the 23rd the depression above mentioned as lying over the north of England on the 22nd, suddenly changed its direction, and passing to the eastward reached Denmark, while pressure decreased very rapidly over Scandinavia, and a fresh fall began in the south-west of Ireland. Little change was shewn in temp., but it appeared to have an inclination to fall.

On the 26th an anticyclone lay over the west and north of these Islands, while areas of low pressure lay over the north of Sweden and south of France, and showers of snow or hail were reported from many places in these Islands. Next day pressure was increasing over Scandinavia and Scotland, but was falling slowly elsewhere, and on the following day a general fall of the bar. took place, the fall in these Islands being slight, but in Scandinavia considerable. On the 29th pressure increased over Scandinavia, but continued to fall in other parts (readings being highest off our west coast), and well-defined areas of low pressure over the Baltic and south of France. Temperature was low on the Continent generally, but higher in these Islands, the highest temp. being in the north-west of Ireland.

Lowestoft. H. E. M.

THE SANITARY INSTITUTE AT CROYDON.

(Continued from page 165*).*

Lastly, I come to the rain—and here the points of contact with everyday life and with sanitary matters are so numerous that it is hard to know where to begin and harder still to know when to stop. Fortunately for us all, I need say very little to-day on the relation between rainfall and national water supply, because I stated fully my views upon that subject in my address upon Water Economy at your anniversary meeting; and it is for others either to refute my statements or to carry out the course suggested. Unfortunately there is another course, which is so easy that it is generally preferred— I mean the ruinously costly one of *laissez faire*. The question of national water supply in its broad features is epitomized on page 21 of the address just mentioned,* and

* Sanitary Institute of Great Britain. Address upon Water Economy, by G. J. Symons, F.R.S. Stanford, Charing Cross.

the longer the time before action is taken, the greater will be both the confusion and the cost.

I leave the question of national water economy where I left it before: ripe for the action of our legislators.

The amount of rain is, I need hardly say, a most important element in all sewage questions; I say *all* advisedly, because even where attempts are made to exclude rain water from the sewers, no one claims to have succeeded perfectly, and even if he did, the rain question would very likely come in again as affecting the administration of a sewage farm.

By the bye, I trust that Mr. Rogers Field will try to apply his recent researches upon syphons to the flushing of drains by cumulative discharges of rain water.

The remarkable absence of some classes of disease during the period in 1879 when summer was expected to occur, may have been partly due to low temperature, partly to the absence of the usual supply of unwholesome fruit; but I think part must also be ascribed to the scouring of the streets and drains by the superabundant rains. And there is something else washed by the rain, greatly to the Sanitary advantage of residents in towns—I mean the air. Those who have leisure and inclination can follow this subject up by perusing Dr. Angus Smith's book on "Air and Rain." I will merely call attention to one proof of its important action, which is patent to everybody who uses his eyes—it is an almost invariable action, but I will take a strong though not over-coloured illustration. It is a summer evening, close and thundery, the air is thick partly with moisture, but chiefly with extremely fine dust, particles of almost endless variety, fibres of cotton and of wool, soot, pollen from flowers, granite, road dirt, &c. No thunder occurs, but there is a downrush of colder air; rain begins, and in an hour it is over, and has carried with it to the ground an enormous proportion of the miscellaneous compound which the inhabitants had previously been breathing. If you ask for proof of this, I merely refer you to the street lamps; watch them regularly, and you will find them nearly as good at revealing the dust motes in the air, as the beam of light from Prof. Tyndall's lamp. Under the conditions I have described, they shine with a brilliancy rarely seen. Metropolitan air wants washing, it is wonderfully better for the process, and I suspect that that is one reason for the low mortality in 1879.

Rain as a supply of drinking-water will be considered in one of the papers to-day; and in two or three others we shall have rain before us in its relation to the yield of wells. On those two points, therefore, I need say nothing.

* * * * * * *

RAIN COLLECTED FROM ROOFS CONSIDERED AS A DOMESTIC WATER SUPPLY.

By H. Sowerby Wallis, F.M.S.

Meteorology and Sanitary Science are very closely connected. Meteorology deals with all the properties and changes of the atmosphere which surrounds our earth; and Sanitary Science has to arrive at the best means of keeping that air pure, and in a satisfactory state for respiration, and to deal with the deposits from it, not only to prevent them injuring man, but also to obtain the greatest advantage from them in all ways.

One of the chief points of connection between the two sciences is rainfull; meteorologists study the moisture in the atmosphere, its various forms and conditions, the causes which deposit it on the earth as rain, and the quantity deposited at various places. Then the sanitarian has to take up the question of how it shall be dealt with? which naturally divides into two branches—Water Supply and Drainage, making use of the water, and preventing it doing mischief; and his chief object is so to balance the two as to get rid of it without its doing any harm, and yet to get all the good he can out of it.

We are entirely dependent on rain for our supply of water; for whether we

catch the water which falls on our roofs, or obtain it from shallow or deep wells, or from streams and rivers, it is nothing more nor less than rain. The subject of water supply has many branches, and perhaps the most important is plenty of good water for domestic use, though the supply for manufacturing and general purposes, and for power is of vast importance, and the different interests are generally very conflicting. The agriculturist, to prevent the water standing on his land, drains it into the water-courses, which receiving it quicker than would naturally be the case, overflow and cause mischief by floods; he also manures his fields, and some of the manure is washed down the drains, and instead of enriching the soil, pollutes the water. Then the manufacturer not only wants to receive the water clean and to send it away dirty, but, to get power out of it, he backs up the stream with dams and weirs, and causes floods above him; in short, every riparian owner wishes to receive the water pure and to empty into it all superfluous water, sewage, and refuse of all kinds, and to have absolute control over the river; not caring whether those above and below him are flooded, or deprived of water altogether.

When a supply of water is wanted for a large town, the first question is where is there a large rainfall within reasonable distance? Then geology plays an important part, the structure and natural products of the gathering ground affecting not only the quality and quantity of water that can be made available, but also the cost of the necessary works and reservoirs. For the use of towns the water can be brought in bulk, and having only to be distributed over a small area, the cost though great can be easily met, but in small villages and rural districts the cost of distribution would be so great that a supply in this manner is altogether out of the question. In these districts, however, the importance of a sufficient quantity of pure water for domestic purposes is very great, and seems to be only equalled by the difficulty of obtaining it. The usual sources of supply are the small streams and shallow wells; the streams are scarcely ever pure enough for drinking, and the wells are very frequently much too near cesspools and house-drains, to say nothing of the miscellaneous organic matter with which surface water must necessarily be polluted. This is not all; one well generally supplies several cottages, and the distance which the water has to be carried, prevents it being used in anything like sufficient quantity for thorough cleanliness; and in hot and dry weather, when a plentiful supply is more than ever needed, the well often runs dry, or at least, the scarcity of water causes frequent quarrels.

Perhaps the simplest solution of the difficulty is storing the water which falls on the roofs of houses, if a sufficient quantity can be obtained in this manner, and the object of my paper is to consider this question.

The average rainfall over the British Isles varies from about 20 inches to about 200 inches per annum. The largest amounts being recorded in the English Lake district, and in the mountainous districts of Wales and Scotland; and the smallest in the eastern and midland counties of England. I have selected four fairly representative stations, with average rainfalls of approximately 22, 25, 35, and 45 inches, on which I have based my calculations. Stations where the fall is much above 45 inches are only found in mountainous districts which are generally rocky, and consequently there is no difficulty in obtaining a supply of water from the streams which are numerous, and in such districts usually sufficiently pure. The two average falls, 22 inches and 25 inches, may appear rather near each other in amount; my reason for adopting them was that the 22 inches was the lowest satisfactory average I knew of, obtained from a sufficiently large number of years, and 25 inches represents the fall over a larger part of the country than any other amount.

In dealing with my subject, I shall consider more particularly the supply of labourers' cottages; for although pure water is as necessary to the middle and upper classes of the community, they have the matter more in their own hands, and can, as a rule, meet the necessary expense of procuring a good supply.

Taking the average size of a cottage as 15 ft. by 20 ft., which I think is not far from correct, the average yield of water for a year, with a mean rainfall of twenty-five inches, would be 3,900 gallons, or nearly 10·7 gallons per day,

but this is without allowing anything for loss in collecting, which is considerable. From measurements of the flow of water from a tiled roof in average condition, I find that about twenty per cent. is lost. First, there is the water absorbed by the tiles; then a considerable quantity is held between the tiles by capillarity; and, lastly, some is lost by splashing off the edges of the roof, and out of the gutters. On a slated roof, I believe the loss might be reduced to between five and ten per cent.

Then, also, we must not calculate the supply only from the average rainfall, but from the fall in a dry year. Thus, at a station with a mean annual rainfall of twenty-five inches, the amount in the driest year is about seventeen inches. This would yield 2,653 gallons. Deducting twenty per cent. for loss, 531 gallons; leaves as available supply 2,122 gallons, or little more than 5·8 gallons per day, which would be altogether inadequate for the use of four or five persons—the presumed number of the inhabitants of the cottage.

With a mean rainfall of thirty inches, we should have an average supply of 10·3 gallons per day, and in the driest year 6·9 gallons.

With a 35 in. rainfall 12·0 gallons, and 7·7 gallons per day.
,, 40 ,, ,, 14·5 ,, ,, 10·8 ,, ,,
,, 45 ,, ,, 16·4 ,, ,, 13·1 ,, ,,

I have not been able to find anywhere a statement of the quantity of water per head, per day requisite in rural districts. In towns the quantity varies from about twelve gallons to about fifty gallons; but there can be no comparison, as in towns a large proportion goes for trade supply and for general sanitary purposes; a great deal is wasted by bad fittings; and the amount used for water-closets, which are almost unknown in country cottages, is, I believe, considerably more than half the quantity delivered to each house.

I think there can be little doubt, that a cottage with an average supply of twelve gallons per day of pure water close to the house, would be considerably better off than nine-tenths of the English cottages in their present condition; but this could only be obtained from a tiled roof in places where the mean rainfall was thirty-five inches and upwards. In places where the rainfall was less, this method could only be adopted with satisfaction as a supplemental supply, or for potable water where there was another supply for cleansing purposes.

It is of considerable importance that the water collected on roofs be properly stored. A gread deal might be said about the objection to storing in wooden butts, or cisterns of any kind above ground which are often exposed to the sun, and are liable to receive various impurities, the water becoming unfit for consumption after a very short time, and I believe it is from this cause that a great deal of the prejudice against rain-water as a beverage has arisen, for if properly stored it is probably the most wholesome of all waters. The best receptacle is an underground tank or well, bricked at the sides and bottom, and lined with about half an inch of Portland cement, to prevent any possibility of loss from leakage or pollution from the infiltration of impure water from the surrounding ground; the top should be domed over, leaving a man-hole, so that the tank may be occasionally cleaned; the man-hole should be covered with a slab of paving stone laid in mortar, to prevent worms or other insects getting in and polluting the water. The pipes from the roof to the tank where they pass underground should he of glazed earthenware, and the joints made of cement, so as to be both watertight and impregnable to insects and other polluting matter from the outside. They should not go straight into the tank, but into a small receptacle beside it, in which any dead leaves or other matter carried down from the roof would be intercepted, so as not to reach the tank and decay in the water. This receptacle should be made with a closely-fitting movable cover, so that it could be occasionally cleaned, which would aid materially in keeping the water pure. The tank should also have a waste-pipe to allow any surplus water to escape, the end of which should be covered with a piece of perforated zinc or copper wire gauze, to prevent frogs, mice, or other vermin having access to the water. A tank carefully constructed in this manner will not require cleaning more than once in two or three years.

The size of the tank is perhaps the next point for consideration; to insure a regular daily supply proportionate to the yearly fall, the tank must be of sufficient capacity to store all the water that falls during the wet periods of the year, for if during the spring some of the heavy rains run to waste, the water kept in store will not be adequate to meet the daily demand during the dry summer weather, for it is evident that anything deducted from the yearly amount of rain even during the wettest season must of necessity reduce the average daily supply that it is capable of yielding. I have, therefore, calculated the requisite capacity of the tank from the surplus yield of water during the three wettest months, and find that for a cottage 15 ft. by 20 ft.—the size on which I have based all my calculations—with a rainfall of 20 inches, the tank would require a capacity of 150 cubic feet, or 5 months' supply

with a rainfall of	25	inches,	200	,,	5	,,	,,
,,	,,	35	,,	235	,,	4	,,	,,
,,	,,	45	,,	250	,,	3	,,	,,

The decrease in the proportionate size of the tank with larger rainfalls is due to the different relation which the wet periods in dry districts bear to those periods in wet districts; that is to say, that where the average rainfall is 20 inches, the fall during the wettest three months will be about 75 per cent. of the mean annual fall; while at stations where the mean rainfall is 45 inches, the wettest three months will be only about 50 per cent. of the annual fall. Or, to put it very simply, at wet stations the fall is more evenly distributed over the year.

The cost of tanks such as I have described is not great, and would not exceed one shilling for each cubic foot of capacity, that is a tank holding 100 cubic feet would cost £5, and so on. When a storage capacity of more than 200 cubic feet is required, it will be found advantageous to make two or more tanks rather than one large one.

In the foregoing I have worked on an average condition of things, and of course the results are averages, and there are various disturbing elements; as before stated, I have taken as my basis a cottage having an area of 300 square feet with a tiled roof in fair condition, the inclination of the roof being about 35°. I do not think the inclination of the roof has much effect, for though a steep roof would catch rather less water it would run off more freely and less would be held between the tiles by capillarity; of course with a very flat roof the conditions would be reversed. On a slated roof there can be no doubt that the loss would be less, and, as before mentioned, need not exceed 10 per cent.

I think the most important element is the position and bearing of the house, for if a house has a large expanse of steep roof facing a wet wind, it will, undoubtedly, catch more than the average, especially if it is in an exposed situation. I believe, as a general rule, a flat roof will catch most water in a sheltered position, and a steep roof in an exposed position, if it presents a fair proportion of roof to the wet winds.

It is hardly necessary to state that in calculating the yield of water from any roof, the area of the ground covered by the roof should be taken, and not the area of the roof itself.

The question of Water Supply is perhaps engaging more attention now than it has ever done before, and I hope the few facts I have given on what appears to me one of its most difficult bracnhes, and at the same time one that seems most likely to be overlooked—the supply of country cottages—have not been altogether useless or uninteresting.

In conclusion, I should like to express my thanks to the President, Mr. Symons, for allowing me the free use of his rainfall records, which were so essential for the compilation of this paper.

[The tables accompanying this paper will be printed *in extenso* in the Transactions of the Sanitary Institute.]

THE INFLUENCE OF WEATHER ON DISEASE.

Mr. Corden began by saying that, having contributed the meteorological

element in the Croydon mortality returns for some years, he ventured to submit a short paper on the influence of weather on certain classes of disease in the district. The diseases illustrated were those of the zymotic class, and to facilitate the study of the subject he drew up a table calculated to show at a glance the annual and quarterly death-rates from those diseases, together with the mean temperature and rainfall for the same time, and extending from 1865 to 1878, a period of 14 years. Having divided the period of time into two portions of seven years each, and calculated the averages, he found that the general death-rate from all causes for the first period was 20·51 per 1,000 living, and for the second only 18·62, thus showing a gain of 2 per 1,000. He next took the seven principal zymotic diseases, and found that the death-rate from them for the first period was 3·6, and for the second 2·8 per 1,000, showing another improvement. In comparing the quarterly averages, he found that for the third quarter of the year for the second period there was a slight increase in the number of zymotic deaths, but in the remaining quarters a decrease. The annual mean temperature of the first period was 49°·97, and of the second 50°·67. The average rainfall per annum for the first period was 26·61 inches, and for the second 28·52 inches. The mean temperature of the first and fourth quarters was, in the second period, as much as 2°, and 10° respectively, higher than in that of the first; the mean of the second and third quarters remaining nearly stationary. The first and third quarters in the second period showed a diminution in the rainfall, but the second and fourth a large increase, the fourth to the extent of 2¼ inches. The mean temperature for the whole period of 14 years was 50°·3, which is about the usual figure. The annual average rainfall for the whole period was 27·56, or 1·5 in. above the average of a large number of years. After examining the results given by various years, he came to the conclusion that the years mostly prevalent with zymotic disease were those in which there have been long periods of dry weather interspersed with occasional heavy rains, as in 1865 and 1870. In the case of 1865, although the total rainfall for the year was large, being over 30 inches, still it was remarkable for the irregularity of its distribution, and for the smallness in number of rainy days; for instance, there were but three days' rain in April, giving only 0·17 of an inch, whilst 11 days in May gave 3·40 inches, one day of which had a fall of 1·20 in., and another of 1·10 of an inch during thunderstorms. Again, in September there was but one day on which it rained to the amount of 0·27 of an inch, whilst in October there were 23 days of rain to the amount of 7 inches. The year began with a very low zymotic death-rate, viz., 1·56 in the first quarter, and ended with a very high one, 8·80 in the fourth quarter; such a high zymotic death-rate in any one quarter has not been equalled since. The rainfall of the next year (1866) was very large, over 32 inches, with a much larger number of days, and as the year went on it showed a rapidly-decreasing death-rate from zymotic diseases, the rate per 1,000 in the fourth quarter being only 2·18.

(To be Continued.)

THE FROST OF DECEMBER, 1879, IN ENGLAND AND ITALY.

To the Editor of the Meteorological Magazine.

SIR,—The following figures may be interesting:—

	Aysgarth Vicarage. 660 ft.		Pasture near stream, ½ mile distant. 480 ft.
	Min. at 4 ft.	Exposed ther. on snow.	Min. at 4 ft.
December 4th	+ 2·7	—2·0	—4·7
,, 5th	12·2	—1·0	—1·8
,, 7th	9·2	+6·0	—0·5

The 4th uncommonly severe. Thermometer as low as +2°·7 at

this height shows great *general* depression of temperature. The 7th was the coldest at Thirsk, Ripon, &c., where it is said to have been from 6° to 8° below zero, but here rapid fluctuations and a relatively high radiation thermometer indicated as early as 8 p.m. on the 6th that a change was setting in, and *had set in above.*

F. W. STOW.

Aysgarth, Bedale.

To the Editor of the Meteorological Magazine.

SIR,—It may interest you to hear that the usually favoured shores of the Mediterranean have not escaped their share of the recent severe cold. A heavy thunderstorm on December 1st has been followed by a succession of frosts of a severity unprecedented in this district. On December 2nd a thermometer by Casella registered 25° in a very sheltered part of Mentone, the snow both there and at Bordighera lying for two days close to the edge of the sea.

The gardens all along the coast are terribly disfigured, and the olives and lemons, both of which promised an exceptionally heavy crop, are sadly cut up. In the Mentone valley the lemon trees seem all but killed, and various estimates put the loss of olives round San Remo at from half to three-quarters of the crop.

Yours faithfully,

PERCY BICKNELL.

San Remo, Italy, Dec. 10th.

[If our readers will favour us with the minimum readings of accurate thermometers properly mounted, we shall be happy to classify them for our next number.—ED.]

CLIMATOLOGICAL STATIONS.

[The following circular has been issued to all the Fellows of the Meteorological Society. We reprint it here because some of our readers who are not yet Fellows of the Society may be interested in it, and willing to furnish observations.—ED.]

METEOROLOGICAL SOCIETY,
30, Great George Street, Westminster,
November, 1879.

SIR,—The Council have decided upon establishing a number of stations especially intended for elucidating the peculiarities of the Climates of different Health Resorts. They wish that these stations should be numerous rather than elaborately equipped, and consequently the instruments required are merely the following :—

Maximum Thermometer	divided on the stem and verified.			
Minimum	,,	,,	,,	,,
Dry Bulb	,,	,,	,,	,,
Wet Bulb	,,	,,	,,	,,
Rain Gauge.				

The thermometers must be mounted in a Stevenson stand, and read once daily at 9 a.m.

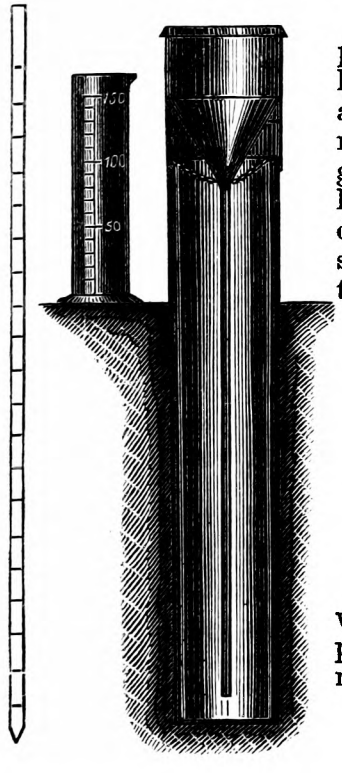
The Council are desirous that there should be a wide distribution of stations furnishing these data, and also that the differences of climate due to the varieties of physical configuration even in such small distances as, for instance, the higher and lower parts of Torquay, should be represented by separate returns.

It is intended that this system, which will be concurrent, and in no way clash, with the Society's present series of Second Order Stations, should commence on January 1st, 1880; the Council will therefore be glad if all those Fellows who are prepared to comply with the above conditions, will communicate with the Assistant Secretary as soon as possible, so that the requisite forms may be issued forthwith.

We are, Sir, your obedient servants,
G. J. SYMONS,
JOHN W. TRIPE, M.D., } *Hon. Secs.*

CHEAP MOUNTAIN RAIN GAUGE.

To the Editor of the Meteorological Magazine.



SIR,—With reference to your recent plea for additional rain-gauge stations, it has occurred to us that possibly you will allow us to call attention to a slight modification of our indestructible rain-gauge, whereby it is rendered suitable for holding a month's rainfall, even in a wet district. The only alterations, as you will see by the specimen sent herewith, are the following:—

(1) The receiving can is so lengthened as to hold 20 inches of rain.

(2) The measurement can be taken by inserting a graduated dipping rod, or by—

(3) The measuring jar, which is larger than usual, holds an inch and a half of rain, and is graduated to 0·05 in.

Of course we do not specify price, but we may say that it is moderate as compared with any gauge of equal capacity now in the market.

Yours truly,
NEGRETTI & ZAMBRA.

NOVEMBER, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	·73	— 1·68	·27	21	8	55·2	18	23·0	16	15	22
II.		Maidstone (Hunton Court)	1·38	— 1·65	·49	21	13	...	...	...	...	...	...
,,		Selborne (The Wakes)	2·32	— 1·22	1·00	21	6	55·0	18	15·0	23	14	19
III.		Hitchen	·75	— 1·39	·19	20	12	50·0	17†	21·0	14	17	...
,,		Banbury	·75	— 1·45	·21	20	14	53·5	18	20·5	15	18	...
IV.		Bury St. Edmunds (Culford)	1·47	— ·92	·42	23	15	51·0	18	18·0	15	19	24
,,		Norwich (Cossey)	2·25	...	·44	23	19	51·0	5‡	23·5	22	11	16
V.		Bridport	·21	— 2·95	·11	9	3	...	...	...	...	...	...
,,		Barnstaple	·80	— 3·34	·31	20	5	56·0	20	27·0	14¶	...	...
,,		Bodmin	1·15	— 3·83	·32	30	12	56·0	19	26·0	30	11	16
VI.		Cirencester	·38	— 2·34	·15	20	3	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	·86	— ·71	·34	20	11	54·0	18	19·0	15	18	19
,,		Tenbury (Orleton)	·99	— 1·48	·35	20	15	58·7	18	17·2	22	16	16
VII.		Leicester (Town Museum)	1·09	...	·37	20	16	55·2	18	23·5	15	13	23
,,		Boston	1·15	— ·99	·27	20	12	52·0	5	25·0	16**	13	...
,,		Grimsby (Killingholme)	1·89	...	·63	20	17	52·0	6	26·0	22	5	...
,,		Mansfield	1·59	...	·56	20	12	56·3	18	18·9	22	15	20
VIII.		Manchester (Ardwick)	1·27	— 1·36	·53	12	13	53·0	7, 18	...	...	11	...
IX.		York	1·20	— ·78	·25	1, 20	14	57·0	5	24·0	23	12	14
,,		Skipton (Arncliffe)	2·66	— 3·79	1·04	11	15	57·0	7	23·0	13	11	...
X.		North Shields	3·82	+ 1·12	1·02	1	21	55·0	7	26·5	30	8	10
,,		Borrowdale (Seathwaite)	3·87	—12·80	1·70	11	14	...	...	...	...	...	...
XI.	WALES.	Cardiff	·43	...	·18	20	8	60·4	18	24·2	30	8	...
,,		Haverfordwest	1·66	— 4·01	·75	30	8	58·0	19	22·5	21	15	16
,,		Lampeter (St. David's Coll.)	...	...	...	...	...	...	...	...	...	...	...
,,		Llandudno	·98	— 2·18	·26	23	11	54·2	19	32·0	14	1	...
XII.	SCOTLAND.	Cargen	1·01	...	·38	11	6	57·0	7	22·6	...	13	...
,,		Hawick (Silverbut Hall)	1·98	...	·65	21	11	...	...	...	...	...	...
XIV.		Annanhill	1·28	...	·53	9	13	54·8	20	24·0	30	12	17
XVI.		Kilmory	2·27	...	·58	9	10	...	...	23·0	30	11	...
,,		Mull (Quinish)	2·45	...	5·6	8	15	...	...	...	...	...	...
,,		Loch Leven	1·80	— 1·85	·60	10*	7	...	...	...	...	...	...
,,		Loch Long (Arddaroch)	2·31	...	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	1·96	— ·93	·78	21	9	57·0	18	28·0	30	...	5
,,		Braemar	2·75	— ·07	·66	21	17	57·8	18	16·0	14	15	23
XVIII		Aberdeen	2·76	...	·43	21	21	57·5	17	29·0	30	4	15
,,		Portree	5·31	— 5·17	1·53	16	23	...	...	...	...	...	...
,,		Inverness (Culloden)	2·74	+ ·15	1·07	24	9	56·0	17	25·9	26	6	15
XIX.		Dunrobin	3·00	+ ·69	·54	11	16	53·0	9	28·0	30	6	...
,,		Sandwick	3·62	— ·38	·52	16	27	53·0	9	28·8	30	3	10
XX.	IRELAND.	Caherciveen DarrynaneAbbey	·75	...	·18	9	9	...	...	...	...	...	...
,,		Cork	...	...	...	...	...	...	...	...	...	...	...
,,		Waterford	·45	— 3·50	·15	9	8	58·0	18	29·0	30	7	...
,,		Killaloe	·99	— 3·90	·39	9	10	58·0	18§	28·0	13	8	...
XXI.		Portarlington	·78	— 3·14	·19	9	10	57·0	19	29·0	29	8	...
,,		Monkstown, Dublin	1·31	— 1·58	·32	9	11	...	...	...	...	...	...
XXII.		Galway	·88	...	·45	9	10	57·0	28	28·0	2, 27	6	...
XXIII		Waringstown	1·29	...	·57	9	15	59·0	18	20·0	30	11	16
,,		Edenfel (Omagh)	1·36	...	·55	9	20	56·0	17‖	22·0	30	12	...
,,		Ballinfull	...	...	...	...	...	...	...	...	...	...	...

* And 22. † And 18. ‡ And 6, 7. § And 19. ‖ And 18. ¶ And 30. ** And 23.

+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON NOVEMBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

HITCHEN.—Only two drier and three colder Novembers for 30 years.

CULFORD.—A month of exceedingly cold and winterly weather, S falling more or less on 11 days. Heavy fogs on and about the 24th. Mean temp. 37°·3, below the average. Swallows left here about the middle of October, but a solitary one was seen on the 2nd. North-westerly winds prevailed during the greater part of the month.

COSSEY.—S about 5 inches deep on the level on the 30th.

BODMIN.—Mean temp. 40°·2. There is no remembrance here of so little R in November, nor of so low a temperature.

CIRENCESTER.—An unusually dry month; cold towards the end.

SHIFNAL.—One of the driest and coldest Novembers we have had for years, only two drier for 44 years—Nov., 1855, when ·57 in. fell, and 1858, ·61 in. First S fell on the 20th. Wind persistently from N.W., N. and N.E. Ice would bear on 16th. A fine wheat seed time.

ORLETON.—The first half of the month was generally cloudy and dry, with an even temperature and high bar. On the 14th frost set in, and, with the exception of the 17th, 18th and 19th, which were very warm, continued till the end of the month, with frequent light falls of S. The mean temp. of the month was about 2° below the average, and the fall of R and S was very small, not being one half of the average. Great darkness for about an hour occurred on the 20th, 21st and 26th, and there were only a few clear days.

GRIMSBY.—Very cold month; the first half dry, the second wet.

YORK.—First S on 1st. Ice bore on 15th.

ARNCLIFFE.—Violent TS at 5 p.m. on 11th; bar. fell rapidly.

WALES.

HAVERFORDWEST.—This November is remarkable for its high bar., absence of R, for the dry condition of the air, and the absence of storms of wind; it was the driest November during the past 31 years, the next to it being 1871, when 1·81 in. fell. Bar. pressure very high. I have no remembrance of so fine a November; its value to the farmers cannot be fully estimated.

LLANDUDNO.—Month dry, but deficient in sunshine. Mean temp. about a degree and a half below the average, though only one night's frost. A gale of wind from N. on the 12th, and another still heavier from E.N.E. on the 21st.

SCOTLAND.

CARGEN.—The driest November recorded here for 20 years.

ANNANHILL.—Mean temp. 40°·8. Prevailing winds N.E. and N.W., usually light to moderate. W.S.W. gale on 11th.

QUINISH.—A very fine, dry month, and particularly calm, the 11th and 12th being the only rough days. Hard frost from 24th to 30th.

BRAEMAR.—Hurricane of wind from 9 p.m. on 11th to noon on 12th.

PORTREE.—On the whole, a mild month. N.W. gale on 11th. Four last days of month frosty, with showers of S. Crops all secured; cattle and sheep in good condition.

CULLODEN.—Month generally fine; no severe frost. Heavy rainfall on night of 23rd and 24th.

SANDWICK.—The weather was open until 29th, when a snowstorm began and still continues (Dec. 2nd). There was a gale of 60 miles an hour from 1 to 2 a.m. on 12th, and another on 11th.

IRELAND.

DARRYNANE.—The driest month since Jan., 1870. The dryness of this and last month has been of the greatest service to the farmers, &c., as the turf (peat) cut for fuel has dried, a thing which the oldest inhabitant cannot remember to have happened so late in the year.

KILLALOE.—An extremely small rainfall in this district for any month of the year, especially so for November. The month was also remarkable for a greater number of bright sunny days than any of the ten preceding months.

MONKSTOWN.—A fine, bright, and comparatively mild November. Smart frosts on several nights, but nothing approaching November, 1878. Bar. very high.

WARINGSTOWN.—Very fine and dry. Wheat got in, in good order.

SUPPLEMENTARY TABLE OF RAINFALL IN NOV., 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	·94	XI.	Port Madoc	1·24
,,	Littlehampton	·74	,,	Douglas.....	1·29
,,	Dorking, Abinger	1·32	XII.	Carsphairn	1·36
,,	Hastings, Manor House	1·12	,,	Melrose, Abbey Gate...	2·46
,,	Hailsham	1·35	XIV.	Douglas Cas., Newmains	1·20
,,	I. of W., St. Lawrence.	·59	XV.	Islay, Gruinart School..	1·81
,,	Strathfield Turgiss	·82	XVI.	St. Andrew's, Cambo...	...
III.	Great Missenden.....	·51	,,	Aberfeldy H.R.S.	1·12
,,	Winslow, Addington ...	·76	XVII.	Tomintoul.....	3·16
,,	Oxford, Magdalen Col...	·67	,,	Keith H.R.S.	3·85
,,	Northampton	1·16	,,	Forres H.R.S.	1·82
,,	Cambridge, Merton Vil.	·89	XVIII.	Strome Ferry H.R.S....	3·38
IV.	Harlow, Sheering	·72	,,	Lochbroom	3·56
,,	Diss	1·83	,,	Auchnasheen H.R.S. ...	...
,,	Swaffham	1·91	,,	Tain, Springfield.....	1·70
,,	Hindringham	1·86	,,	Loch Shiel, Glenfinnan.	6·43
V.	Salisbury, Alderbury...	·42	,,	Dalwhinnie H.R.S.....	...
,,	Calne, Compton Bassett	·42	XIX.	Lairg H.R.S.	3·02
,,	Beaminster Vicarage ...	·40	,,	Altnabreac H.R.S.	3·35
,,	Dartmoor Prison.....	·48	,,	Watten H.R.S.	2·43
,,	Langtree Wick	·63	XX.	Fermoy, Glenville	·74
,,	Lynmouth, Glenthorne.	1·17	,,	Tralee, Castlemorris ...	·50
,,	St. Austell, Cosgarne...	1·39	,,	Cahir, Tubrid	·53
,,	Taunton	·45	,,	Tipperary, Henry St....	·58
VI.	Bristol, Ashleydown ...	...	,,	Newcastle West	·66
,,	Wem, Sansaw Hall.....	1·10	,,	Kilrush	·75
,,	Cheadle, The Heath Ho.	1·40	,,	Corofin	·79
,,	Bickenhill Vicarage ...	1·09	XXI.	Kilkenny, Butler House	·40
VII.	Coston Rectory	1·60	,,	Carlow, Browne's Hill..	·77
,,	Horncastle, Bucknall...	1·43	,,	Kilsallaghan.....	1·19
VIII.	Walton-on-the-Hill.....	1·12	,,	Navan, Balrath	·77
,,	Broughton-in-Furness ..	1·36	,,	Athlone, Twyford	·65
IX.	Wakefield, Stanley Vic.	·96	,,	Mullingar, Belvedere ...	·67
,,	Ripon, Mickley	1·30	XXII.	Ballinasloe	·66
X.	Gainford	·98	,,	Clifden, Kylemore	1·54
,,	Haltwhistle, Unthank..	1·78	,,	Crossmolina, Enniscoe..	2·21
,,	Shap, Copy Hill	1·40	,,	Carrick-on-Shannon ...	·91
XI.	Llanfrechfa Grange	·85	,,	Dowra	1·53
,,	Llandovery	·71	XXIII.	Rockcorry.....	1·11
,,	Solva	1·08	,,	Warrenpoint	1·16
,,	Castle Malgwyn	1·91	,,	Newtownards	1·09
,,	Rhayader, Nantgwillt..	1·51	,,	Larne, Carnlough	1·43
,,	Carno, Tybritle	1·53	,,	Bushmills	1·58
,,	Corwen, Rhug	1·07	,,	Buncrana, Rockfort ...	1·96

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CLXVIII.] JANUARY, 1880. [PRICE FOURPENCE. or 5s. per ann. post free.

LOW TEMPERATURES IN DECEMBER, 1879.

ALTHOUGH we have not received as many abstracts of low temperatures as we expected in response to the note on page 180 of our last number, we think that the following list is by no means short, and it is not as full as it might have been made, for we have not thought it worth while to reprint the temperatures given in columns 10 and 11 of the table on page 194.

Looking at the whole of the figures, one is much struck by the irregular distribution of the cold both as regards date and intensity. There is every date from the 2nd to the 7th, both inclusive; and stations close together often report very different values—*e.g.*, Beech House, Cambridge, +5°·0; Observatory, Cambridge, 0°·0; and Merton Villa, Cambridge, —2°·0: 7° difference between two stations hardly a mile apart.

As regards the record which heads the list, there can apparently be little doubt that it is entitled to that position, but the thermometer was not a verified one, and we do not know exactly how it was placed. Mr. Coventry writes as follows—

"The thermometer I had in use was too small to admit of its registering lower than —6°; but another thermometer, in an exposed position, was observed by one of our gardeners to register —11°, of the correctness of which I have no doubt. I have compared the thermometer I observed in December with Rutherford's and Phillips's, and I find both agree."

PLACE OF OBSERVATION.	AUTHORITY.	Lowest Temp.		Stand.
		Degree.	Date.	
Ketton Hall, Stamford	F. Coventry, Esq.	—11·0	6	
Hodsock Priory, Worksop	H. Mellish, Esq.	*— 5·8	7	S.
Lauder Grange, Corbridge-on-Tyne	T. Hurst, Jun., Esq.	— 5·0	4	
Millfield, Haddington	Mr. C. J. Dods	— 5·0	4	
Abbey Gate, Melrose	Mr. A. Dodds	— 5·0	4	
Coston Rectory, Melton Mowbray	Rev. A. M. Rendell	— 4·5	2	
Pawston, Cornhill-on-Tweed	B. P. Selby, Esq.	— 4·0	4	
Much Hadham, Ware	Rev. H. S. Mott	— 3·0	7	
Merton Villa, Cambridge	G. Warren, Esq.	— 2·0	7	
Gainford, Durham	A. Atkinson, Esq.	— 2·0	3	
Bucknall, Horncastle	W. Carter, Esq.	*0·0	7	
Moor Hall, Harlow	Mr. H. Huntley	0·0	7	S.

PLACE OF OBSERVATION.	AUTHORITIES.	Lowest Temp.		Stand.
		Degrees.	Date.	
Dunmow, Essex	H. E. Cockayne, Esq.	0·0	...	
Stanley Vicarage, Wakefield	Rev. R. Burrell	0·0	6	
Cambridge Observatory	H. Todd, Esq.	0·0	6, 7	
Sheering Rectory, Harlow	Rev. E. Hill	1·0	7	
Victoria Street, Loughborough	W. Berridge, Esq. F.M.S.	*1·5	2, 7	
Cossey, Norwich	H. Culley, Esq.	4·0	2	
Elswick Lodge, Garstang	S. King, Esq.	*5·0	4	S.
Addington, Winslow, Bucks.	Mr. J. Mathison	5·0	7	S.
Grammar School, Burton-on-Trent	C. U. Tripp, Esq.	5·0	7	
Old Ballikinrain, Stirling	Miss Anstruther	*5·0	4	
Beech House, Cambridge	J. Nutter, Esq.	5·0	7	
Priory Row, Coventry	J. Gulson, Esq.	5·0	7	
Abinger Hall, Dorking	Mr. G. Payne	5·0	...	
Colney Hatch, Middlesex	J. Thrustans, Esq.	6·8	7	
Kembach, Fife	J. Makgill, Esq.	7·0	4, 5	
Bushy Hill, Cambuslang, N.B.	Dr. Muirhead	7·0	4	P.
Berkhampstead	W. Squire, Esq.	7·0	7	G.
Broughton, Banbury	E. C. Morrell, Esq.	*7·6	7	P.
Eltham Green, Kent	E. J. C. Smith, Esq.	7·7	2	
Wansford House, Watford	J. Hopkinson, Esq. F.M.S.	7·8	7	
The Chase, Enfield	T. Paulin, Esq., F.M.S.	7·9	7	
Magdalen College, Oxford	E. Chapman, Esq.	9·0	7	
Bickenhill Vicarage, Warwick	Rev. W. R. Capel	9·0	...	
Altarnum Vicarage, Launceston	Rev. J. Power	10·0	2	
Stonor Park, Oxford	Mr. T. Spring	11·0	7	
St. Giles Street, Northampton	H. Terry, Esq.	11·0	6	
Leaton, Shrewsbury	Rev. E. V. Pigott, F.M.S.	*11·9	2, 4	S.
Twyford, Athlone	J. Hodson, Esq.	12·0	5	
Ballinasloe, Galway	W. H. Kempster, Esq.	12·0	5	
Holt, Trowbridge	Major Gritton, F.M.S.	12·2	2	
Achonachie Lodge, Beauley	W. C. Preston, Esq.	13·0	1	
Compton Bassett, Calne	Mr. J. Allen	13·0	7	
Woolston Lodge, Southampton	F. Ekless, Esq.	13·5	7	
Addiscombe, Croydon	E. Mawley, Esq., F.M.S.	13·6	7	
Lowestoft	S. H. Miller, Esq., F.M.S.	13·8	7	
St. John's Wood, London	H. S. Wallis, Esq., F.M.S.	*14·2	7	S.
Breeze Hill, Liverpool	A. R. Andersson, Esq. FMS.	15·0	3	
Beaminster	Rev. A. Codd	15·0	4	
Farley, near Cheadle	C. L. Wragge, Esq., F.M S.	17·0	5	S.
Tenterden, Kent	J. Ellis Mace, Jun., Esq.	18·0	7,17	W.
Langton Herring, Weymouth	Rev. C. H. Gosset	18·0	5	
Sansaw Hall, Shrewsbury	F. G. Tippinge, Esq. F.M.S.	18·0	5	
The Heath House, Cheadle	J. C. Philips, Esq., F.M.S.	18·0	5, 7	
Cosgarne, St. Austell	J. Truscott, Jun., Esq.	18·4	5	
Hinderton, Neston	R. Bushell, Esq., F.M.S.	19·5	4	S.
Llanfrechfa Grange	F. J. Mitchell, Esq.	20·0	7	
Buncrana, London	T. Colquhoun, Esq.	20·0	3	
Woodway, Teignmouth	G. W. Ormerod, Esq., FMS.	21·3	...	
Sidmouth	Dr. Radford, F.M.S.	*21·0	5	S.
St. Lawrence, Isle of Wight	Rev. C. Malden	22·0	5	
St. Aubin's, Jersey	J. E. Vibert, Esq.	22·7	3	
Babbacombe, Torquay	E. E. Glyde, Esq., F.M.S.	*22·8	...	S.

The Readings marked with an (*) were registered by thermometers verified at Kew Observatory.

References respecting Thermometer Stands—S., Stevenson's; P., Pastorelli's; G., Glaisher's; W., Wall.

THE SANITARY INSTITUTE AT CROYDON.

(Continued from page 179).

In 1870 (the chart for which year was shown in contrast with that of 1879) a very similar state of things took place, the temperature of the summer being high and the rainfall very deficient, quite a drought having prevailed, with occasional heavy rains. In that year the zymotic death-rate was high from scarlet fever and diarrhœa. The years which had the greatest number of rainy days were found to have the lowest zymotic death-rate, as in the present year, the rainfall to the end of September having been 28·03 inches, or 10 inches more than the average, and the number of days 156, or 53 more. During the past summer almost continuous rain has fallen, and temperature has been low, the zymotic death-rate has consequently been low, diarrhœa has been conspicuous by its absence, the low temperature and moist atmosphere having been alone responsible for the generally high death-rate, which was caused by the great mortality from respiratory diseases. This year was the third instance since 1865 of continuous rain having brought with it a low zymotic death-rate. One point more was alluded to, viz., the great difference between the nature of the rainfall of the last four or five years, and that of previous years, the falls being much heavier, and the opinion was expressed that much of the unusual prevalence of fever since 1874 has been caused by the frequent exceptionally heavy rains, especially those which occur at night, when, unless there is a distinct and ample provision for storm-water, it must enter with great force and volume into the sewers, the lower parts of which become flooded, at the same time that the ventilators in the streets become choked, and forcing the sewer gas to make its escape to the higher levels, it enters the houses placed ready to receive it. Heavy rains in the day time do not so much matter, for the houses are open, and it is very seldom that a heavy rain occurs at night which might be called sufficient to produce an epidemic of fever, and which should be at the rate of at least an inch in an hour. An instance was given of such a rain having occurred soon after midnight on the 24th of September, 1875, during a violent thunderstorm, when 1·13 of an inch of rain fell in an hour, and as that time the storm-water was not cut off from the sewers, and the main sewer itself was in an unsatisfactory condition, the opinion was expressed that to some extent it was answerable for the second outbreak of fever that year which occurred two or three weeks afterwards. This seemed all the more probable, seeing that there were two distinct periods of great activity, as though there were some disturbing causes at work which only require to be removed that the results might cease. In conclusion, he was aware that great efforts had been made by the local authorities since 1875 to cut off all direct communications between the sewers and the interior of houses, and also to divert the surface and storm water from the sewers; but still, much remains to be done, and until done, and that thoroughly, if the present abnormal condition of rainfall is to continue, so zymotic diseases might rear their ugly heads amongst us. At the same time there was much to be thankful for in the fact that zymotic diseases were occasional visitors only, and the general death-rate of the district was very much below that of large towns generally, and frequently below the average of all England.

In the discussion that followed this paper, Dr. Black and Dr. Carpenter took part, and a paper was read on the subject of meteorology by Mr. Mawley, of Addiscombe.

TEMPERATURE AT NANCY AND STRASBURG.

To the Editor of the Meteorological Magazine.

SIR,—The enclosed account of the weather at Nancy during the late frost is perfectly reliable, and it is so interesting that I send it

you, in case you would like to insert it in the *Meteorological Magazine*.—Yours truly,

P. P. PENNANT.

Nantlys, St. Asaph, 3 Jan., 1880.

REGISTER OF TEMPERATURE AT NANCY AND STRASBURG,

For the Frost of November and December, 1879.

DATE.	NANCY.		Meteorological Sation at Belle Fontaine.	At Enzheim, Rhine Valley, nr. Strasburg.	REMARKS.
	Min.	Max.			
			Min. only at 8 am		
Nov. 25...	+30	+37	+28	...	
,, 26...	+23	+31	+26	...	
,, 27...	+26	+28	+21	...	Wind generally N.E., varying by E. to S.E. all the time.
,, 28...	+16	+29	+14	...	
,, 29...	+18	+30	+12	...	
,, 30...	+26	+31	+17	...	
Dec. 1...	+25	+31	+19	...	
,, 2...	+20	+22	+12	...	A bitter cold day, with wind; the first really cold day.
,, 3...	+ 2	+17	— 9	...	
,, 4...	+10	+32	+ 3	...	Heavy snow.
,, 5...	+20	+22	+16	...	Ditto continued.
,, 6...	+16	+24	+16	...	Ditto, with much wind, fearful storm at times.
,, 7...	— 5	+10	—17	+10	Bright, fine, and cold.
,, 8...	—12	+ 4	—22	— 9	Ditto very cold.
,, 9...	— 7	+13	—18	+ 1	Ditto fine, and cold.
,, 10...	—11	+12	—19	—16	Bitter cold, overcast.
,, 11...	+17	+22	— 5	+12	Much warmer, slight snow.
,, 12...	+24	+26	—17	+17	Ditto.
,, 13...	+20	+26	—15	+22	Ditto.
,, 14...	+ 2	+17	— 8	+10	From 14th to 19th inclusive the sun shone bright all day from sunrise to sunset, without a cloud in the sky, and hardly a breath of wind. I have never seen more lovely winter weather, though very cold.
,, 15...	+ 7	+19	— 5	+ 1	
,, 16...	zero.	+16	—12	— 5	
,, 17...	— 3	+16	—11	—16	
,, 18...	+ 6	+23	+ 1	— 5	
,, 19...	+12	+30	zero.	+ 8	
,, 20...	+18	+25	+15	+ 8	Wind nearly north; a dull, cold day.
,, 21...	zero.	+13	— 3	+12	Very heavy hoar frost; moisture in air.
,, 22...	— 3	+15	— 8	...	
,, 23...	zero.	+26	— 7	...	A bright, cold day.
,, 24...	— 3	+15	— 8	...	Hoar frost.
,, 25...	— 3	+16	— 5	...	Ditto.
,, 26...	+ 8	+26	— 1	...	Cold wind, inclined to shift to south.
,, 27...	+17	+24	+14	...	Ditto ditto ditto.
,, 28...	+ 1	+26	— 8	...	Very heavy hoar frost. Thermometer stood as low as 12° Faht. at noon, when it began to rise, and continued to do so all through the night, standing at 28° at 7 a.m. on the 29th, the rise continuing all through the day. Wind about S.S.W.
,, 29...	+28	+35	+25	...	

\+ means above zero Fahrenheit; — means below zero Fahrenheit.

NOTE.—The frost lasted just thirty-five days (from 25th November to the

29th December), during which time the thermometer never rose above freezing point. On eleven days the mercury fell to zero Faht., or below it, at Nancy. On the 8th December it fell to 12° below zero F., and never rose higher than 4° above it. The 8th was a bright fine day notwithstanding.

Nancy is 650 feet above sea level. The temperatures are recorded from a thermometer by Steward (Strand), marking both min. and max., one of his best instruments. It was fixed at about 40 feet from the ground, north aspect.

The meteorological station of the Belle Fontaine is in the forest of Haye, five miles N.W. from Nancy, and about 200 feet above it. The situation is a very exposed one, chosen specially to obtain the probably lowest temperatures in the neighbourhood of Nancy, for comparison with other stations in the forest. The thermometers have since been tested to ascertain that the temperatures recorded were quite correct.

I obtained also the min. temp. in the Rhine Valley for comparison from 7th to 21st December inclusive. The instrument not marking a min., they were taken at 8 a.m. each day. Enzheim is about eight miles west of Strasburg, and probably from 500 to 600 feet above sea level.

The mean min. temp. of the 35 days is between 9° and 10° Faht., ; the mean max. temp. is between 22° and 23°.

G. F. PEARSON,
Colonel.

Nancy, 30th Dec., 1879.

THE TAY BRIDGE STORM.

JUST as the gale of October 25th, 1859, is known as the Royal Charter storm, and that of March 24th, 1878, as the Eurydice squall, so will that of December 28th, 1879, go down to posterity as the Tay Bridge storm. We offer no opinion upon the disaster, that would be too great a responsibility to be lightly assumed, but we give a few reports from widely distributed stations. There are two points which may perhaps merit attention—(1) that the evidence of broken trees appears to indicate that the gale was as strong in Argyllshire and in Aberdeenshire as on the banks of the Tay, but (2) we have not heard of any material structural damage to any other erection than the unfortunate bridge.

The following notes are arranged from south to north. Arthurstone is about as much north of Tay Bridge as Kemback is south of it :—

BUSHY HILL, CAMBUSLANG.—Aneroid read as follows :—9 a.m., 29·64 ; noon, 29·45 ; 2 p.m., 29·30 ; 4 p.m., 29·25 ; 6 p.m., 29·10 ; 7 p.m., 29·125 ; 8 p.m., 29·17 ; 9½ p.m., 29·30.—*H. Muirhead, M.D.*

EALLABUS, ISLAY, ARGYLL.—The anemometer here is indexed to register up to 20 lbs. on the square foot, but between 5 and 7 p.m. on 28th it was sent past the index and stood at what I should say was 30 lbs. per square foot.—*J. B. Ballingall.*

ARDDARROCH, DUMBARTONSHIRE.—I have been here upwards of 20 years, but never saw or heard of so fearful and destructive a storm as that of 28th, about 6.30 p.m. Some beautiful Scotch firs, upwards of 120 years old, were blown down, and much damage was done in this locality.—*W. McAllister, gardener to J. White, Esq., of Arddarroch.*

KEMBACK, FIFE.—Heavy gale in afternoon, with mercury about

29·3 in., wind S.S.W., heaviest between 7 and 8 p.m., nearly W. in the squalls. Kemback is about 10 miles south of Tay Bridge.—*J. Makgill.*

ARTHURSTONE MEIGLE, PERTHSHIRE.—Great gale which was at its height at a little past 7 p.m., the moment when the Tay Bridge was blown over. The noise of the wind was like the sound of a great waterfall with a bump at intervals like a heavy thud of a solid substance. Forty-three trees in these grounds were blown down or snapt off above the roots.—*Peter Carmichael.*

BRAEMAR.—Violent hurricane from 6 p.m. to 9 p.m., thousands of trees uprooted.—*J. Aitken.*

ELCHIES, CRAIG ELLACHIE, MORAY.—Hurricane damaging houses and uprooting trees.—*J. Milne.*

KEITH.—Terrific gale from 6 p.m. to midnight.—*J. Masson.*

ACHONACHIE LODGE, BEAULY.—Barometer fell 0·80 in. between 11 a.m. and 8 p.m., great gale from S.W.—*W. Conway Preston.*

SANDWICK.—At 9 p.m. the barometer had fallen to 28·602 in. from 29·400 at 9 a.m., the wind was then quite moderate, but this great fall warned us of the storm which broke out here at 9:30 p.m. Maximum velocity 11 p.m. to midnight, 52 miles.—*C. Clouston, LL.D.*

ROCKFORT, BUNCRANA, LONDONDERRY.—Strong gale from S. in morning, increasing in violence and veering to S.W. and W. until it reached a climax at from 4 to 6 p.m., after which it moderated.—*T. Colquhoun.*

THE SIZE OF FOG PARTICLES.

To the Editor of the Meteorological Magazine.

SIR,—The dense fogs prevalent for some time past have induced me to attempt the measurement of the small particles or drops of water of which they are composed. The size of these particles is by no means uniform even in the same fog, varying from 0·00062 to 0·005 inches, but the larger particles are only to be found in very dense fogs, and at a time when they may be felt like rain upon the face. In cases of mist with a clear sky above, nothing larger than 0·0013 inches has been observed. In Kamtz's meteorology the size of "vesicles of fogs" is said to differ in the different months, and to vary from 0·014 to 0·035 mm., or from 0·00055 to 0·00137 inches. The difference between 0·00055 and 0·00062 inches for the measurement of the smallest particles is not great, when the difficult nature of the subject is taken into consideration, and there can be no doubt that smaller particles exist in fogs than have at present come under my observation, but I am not likely to be mistaken in the size of the larger particles. I am ignorant as to the method by which Kamtz obtained his measurements, but the one I have used appears to me extremely simple, and not liable to any great error. The dull surface which brass acquires by use seems well fitted to shew up

small drops of water upon its surface. A small vessel of this metal, through which water can be made to circulate, is placed under a microscope, fitted with a micrometer eye-piece, and the fog particles are measured as they fall; or the small vessel may be gently moved through the air, in order to catch a greater number. The surface of the brass must be kept near to the temperature of the dew point; if too high the smaller drops will evaporate before there is time to take their measurement; on the other hand, if too low, dew is formed upon the surface, but there is no danger of any error from this cause, the appearances are totally distinct, the dew covers the entire surface, and the drops are too small to be measured; the fog particles, on the contrary, can be seen to fall separately, and are surrounded by a vacant space, like to that which is seen on a dry pavement at the commencement of a shower. Some of the fog particles are flattened by the fall; these give an irregular outline; others appear, under the microscope, as perfectly globular, and unaltered in shape. It follows from this, that when fog and mist are prevalent, *part* of the moisture which is seen upon the earth is caused by rain, pure and simple, and not by the condensation of the vapour in the air. These observations, when combined with others which I have for some years past been making upon dew, lead me to think it highly probable that the annual deposit of real dew upon the surface of the earth does not exceed one inch in depth.

Can any of your correspondents give a good definition of dry fogs, and of their component parts? Are they caused by smoke—by some combination of the temperature of the air with vapour, which causes haziness—or do they only differ in degree from other fogs?

G. DINES.

Walton-on-Thames, Jan., 1880.

THE WEATHER IN DECEMBER.

THIS month began with that cold and wintry weather which occupied so large a portion of it. During the 30th November and December 1st an area of low pressure lay over the North Sea, and moderate to fresh N. winds prevailed with low temperatures in the east, with occasional snow, and milder, fair weather in the west. By the 2nd this depression had travelled southwards over France, the bar. had risen briskly in the south-east, while it had fallen in the west and north, so that pressure had become very uniform, the wind decreased in strength and temp. fell rapidly and was very low. On the evening of the same day pressure was still giving way in the south-west, a brisk S.E. breeze sprang up and temp. began to increase. Next day the conditions were rather complicated, an anticyclone lying over northern England with a large area of low pressure over the Bay of Biscay, and a small depression over Holland, so that S.E. to E. winds prevailed on our and the French western coasts, and variable airs in the east; temperature at the same time rising. The depression over the Bay of Biscay proved to be of considerable consequence, and as it passed in an E.N.E. direction across France caused a brisk fall of the bar. over France, and an E. to N.E. gale in the north and the Channel. On the 5th the lowest pressures were shewn over the northern part of the North Sea, and W. winds and a slight thaw began in the evening with snow, but by the following day the bar. was high and rising over these Islands, the wind being very light from N. with a very hard frost at night.

During the whole of the following week the weather of the British Isles and neighbourhood was governed by a large area of high readings which was formed over the north-east of France and the south of these Islands on the 7th, and soon enveloped the whole of these Islands. In consequence very dry weather was experienced, though in many parts of the country (and especially in London) a great deal of fog or mist prevailed, the densest fog of the week being on the morning of the 13th. The wind generally was light or moderate, being E. over France, S. in the south-west, and W. to N.W. in the north and east. Intense frost prevailed on the 7th over England. A very rapid rise took place on the 8th, but on the 9th the frost was re-established and lasted till the 12th, when the thermometer rose and continued to do so till the close of the week.

The general distribution of pressure during the next week, though subject to slight modification from day to day, differed little on the whole. A large anticyclone (in which readings were very high) was shown in the south, while the lowest pressure was reported from the north of Scandinavia. At first the anticyclone was over the north of France and the Channel, so that E. winds prevailed over France, with hard frost, S.W. winds, and comparatively mild weather over the British Isles and the North Sea.

These conditions continued on the 15th, but on the 16th the anticyclone had shifted somewhat and was shewn over the North Sea, so that the E. wind had spread to our southern coasts, temp. falling generally. On the 17th and 18th the area of high pressure lay over the British Islands, light breezes prevailed, with sharp frost over England on the former day, which, however, gave way to a quick rise of the ther. on the following morning. On the 19th there was scarcely any change, but on the 20th the bar. fell quickly in the south-west, and a rather important depression was found off the south of Ireland, causing strong S.E. winds. This depression apparently moved northwards, and the wind shifted more to the southward. The weather was for the most part dry and moderately fine, but a good deal of fog was reported.

Weather towards the end of the month underwent a gradual, but very decided, change. Throughout the week (21st–27th) an anticyclone lay over France, and an influence extended over south-east England, but in the west and north weather was controlled by cyclones over the Atlantic, so that light airs, fogs and frost prevailed in France and in the south-east of this kingdom, while S.W. to W. winds and high temperature prevailed in Ireland, Scotland, and Norway. On the evening of the 27th, however, the bar. fell very briskly in the north-west, a disturbance (which was succeeded by a still deeper one on the following day) appeared off our north-west coasts, and warm weather became general, with a very severe S. to W. gale. From this time till the close of the year important depressions passed over these Islands, and S.W. to W. gales with rain, hail, thunder and lightning were general: the frost, of course, being entirely broken up.

Lowestoft. H. E. M.

A WHITE FOG BOW.

To the Editor of the Meteorological Magazine.

SIR,—A white fog-bow was noticed here between 11 and 12 o'clock on the morning of December 23rd. A low white fog of varying density was driving before a moderate E.S.E. wind, with sunlight occasionally gleaming through it. In these lighter intervals a distinct white bow appeared on the fog in the N.N.W., at a short distance from the observer.

This bow varied in clearness, generally in proportion to the amount of sunlight, and in its various parts according to the definiteness of the fog on which it was projected. It was perfectly white, but similar in other respects to a rainbow. The weather was frosty.—

Yours faithfully, H. GEORGE FORDHAM.

Odsey Grange, Royston, Jan. 7th, 1880.

SUPPLEMENTARY TABLE OF RAINFALL IN DEC., 1879.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	·81	XI.	Port Madoc	2·43
,,	Littlehampton	·87	,,	Douglas.....	2·39
,,	Dorking, Abinger	·81	XII.	Carsphairn	4·40
,,	Hastings, Manor House	·96	,,	Melrose, Abbey Gate...	2·35
,,	Hailsham	1·20	XIV.	Douglas Cas., Newmains	2·65
,,	I. of W., St. Lawrence.	·91	XV.	Islay, Gruinart School..	3·26
,,	Strathfield Turgiss	1·13	XVI.	St. Andrew's, Cambo...	...
III.	Great Missenden.....	·56	,,	Aberfeldy H.R.S.	1·04
,,	Winslow, Addington ...	·81	XVII.	Tomintoul.....	·70
,,	Oxford, Magdalen Col...	1·08	,,	Keith H.R.S.	1·21
,,	Northampton	·42	,,	Forres H.R.S.	·69
,,	Cambridge, Merton Vil.	·57	XVIII.	Strome Ferry H.R.S....	5·92
IV.	Harlow, Sheering	·89	,,	Lochbroom	5·32
,,	Diss	·69	,,	Auchnasheen H.R.S. ...	...
,,	Swaffham	·81	,,	Tain, Springfield.....	1·54
,,	Hindringham	·95	,,	Loch Shiel, Glenfinnan.	9·32
V.	Salisbury, Alderbury ...	·85	,,	Dalwhinnie H.R.S.....	...
,,	Calne, Compton Bassett	1·02	XIX.	Lairg H.R.S.	2·61
,,	Beaminster Vicarage ...	1·45	,,	Altnabreac H.R.S.	1·33
,,	Dartmoor Prison.....	...	,,	Watten H.R.S.	1·50
,,	Langtree Wick	...	XX.	Fermoy, Glenville	2·55
,,	Lynmouth, Glenthorne.	2·65	,,	Tralee, Castlemorris ...	2·84
,,	St. Austell, Cosgarne...	1·58	,,	Cahir, Tubrid	2·04
,,	Taunton	1·15	,,	Tipperary, Henry St....	2·35
VI.	Bristol, Ashleydown ...	1·25	,,	Newcastle West	3·36
,,	Wem, Sansaw Hall.....	1·02	,,	Kilrush	2·51
,,	Cheadle, The Heath Ho.	1·34	,,	Corofin	3·33
,,	Bickenhill Vicarage ...	·82	XXI.	Kilkenny, Butler House	1·87
VII.	Coston Rectory	1·33	,,	Carlow, Browne's Hill..	2·20
,,	Horncastle, Bucknall ...	·83	,,	Kilsallaghan.....	1·22
VIII.	Walton-on-the-Hill.....	1·75	,,	Navan, Balrath	1·20
,,	Broughton-in-Furness ..	3·78	,,	Athlone, Twyford	2·24
IX.	Wakefield, Stanley Vic.	1·28	,,	Mullingar, Belvedere ...	2·05
,,	Ripon, Mickley	1·48	XXII.	Ballinasloe	3·02
X.	Gainford	·90	,,	Clifden, Kylemore	6·14
,,	Haltwhistle, Unthank..	2·33	,,	Crossmolina, Enniscoe..	4·35
,,	Shap, Copy Hill	5·30	,,	Carrick-on-Shannon ...	2·87
XI.	Llanfrechfa Grange	1·99	,,	Dowra	2·36
,,	Llandovery	4·40	XXIII.	Rockcorry.....	2·28
,,	Solva	1·40	,,	Warrenpoint	2·29
,,	Castle Malgwyn	2·02	,,	Newtownards	1·20
,,	Rhayader, Nantgwillt..	4·97	,,	Larne, Carnlough	2·60
,,	Carno, Tybritle	4·40	,,	Bushmills	2·30
,,	Corwen, Rhug	1·52	,,	Buncrana, Rockfort ...	1·74

ERRATUM.

In Mr. Percy Bicknell's letter on page 180, line 3, *for* "thunderstorm" *read* "snowstorm."

DECEMBER, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	·86	— ·64	·32	30	9	52·8	28	16·1	7	24	29
II.		Maidstone (Hunton Court)	·71	— ·91	·16	5	12	...	...	...	...	...	...
,,		Selborne (The Wakes)	·79	— 1·96	·26	31	7	47·0	28	8·0	7	28	30
III.		Hitchen	·51	— ·80	·16	5	13	49·0	28†	8·0	6	28	...
,,		Banbury	·65	— 1·02	·17	31	12	52·0	28	8·0	7	26	...
IV.		Bury St. Edmunds (Culford)	·52	— ·97	·17	5	7	52·0	31	1·0	6	26	28
,,		Norwich (Cossey)	·69	— ·77	·23	31	11	54·0	28	3·5	7	27	27
V.		Bridport	·97	— 2·40	·34	31	8	...	...	...	...	...	...
,,		Barnstaple	1·54	— 1·58	·56	30	10	56·0	29	21·0	5	...	...
,,		Bodmin	1·94	— 3·30	·49	30	12	54·0	28	20·0	5	16	23
VI.		Cirencester	·88	— 1·41	·28	30	8	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	·85	— ·83	·34	6	7	53·0	28	11·0	7	23	26
,,		Tenbury (Orleton)	1·16	— 1·30	·32	29	7	57·0	28	13·0	7	25	25
VII.		Leicester (Town Museum)	·95	...	·34	31	11	54·9	29	3·0	2	24	30
,,		Boston	·65	— ·84	·21	5	7	53·0	31	0·0	7	26	...
,,		Grimsby (Killingholme)	1·05	...	·21	31	13	53·5	28	10·5	7	19	...
,,		Mansfield	1·15	...	·24	30	10	52·7	29	3·7	7	25	23
VIII.		Manchester (Ardwick)	1·46	— ·70	·54	31	5	48·0	27	10·0	7	6	...
IX.		York	1·24	— ·56	·50	21	7	...	...	—4·5	7	...	...
,,		Skipton (Arncliffe)	3·68	— ·87	1·22	31	10	48·0	13	9·0	6	...	...
X.		North Shields	·68	— 1·52	·18	1,5	11	54·3	1	8·5	4	17	20
,,		Borrowdale (Seathwaite)	12·77	— 4·18	4·02	27	15	...	...	...	...	..	...
XI.	WALES.	Cardiff	2·11	...	·79	31	9	52·8	28	19·2	7	22	...
,,		Haverfordwest	2·46	— 2·37	·57	27	10	52·2	31	11·0	5	19	24
,,		Lampeter (St. David's Coll.)	2·12	...	·45	21	17	...	...	...	...	...	...
,,		Llandudno	1·48	— ·72	·35	31	11	56·0	28	23·0	4,5	10	...
XII.	SCOTLAND.	Cargen	3·70	— 1·01	1·62	27	9	53·6	28	9·0	4	18	...
,,		Hawick (Silverbut Hall)	1·75	...	·76	27	11	...	...	..	...	...	...
XIV.		Annanhill	2·06	...	·53	31	15	55·4	29	10·0	4	17	21
XVI.		Kilmory	5·05	...	1·23	31	16	...	...	12·0	4	14	...
,,		Mull (Quinish)	4·53	...	1·25	27	18	...	...	...	...	...	...
,,		Loch Leven	1·60	— 2·12	·50	29	8	..	...	...	...	...	...
,,		Loch Long (Arddaroch)	5·41	...	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	·94	— 1·80	·36	2	5	47·0	14	12·0	4	20	...
,,		Braemar	1·51	— 2·26	·65	27	10	51·7	28	—1·0	3,4	21	31
XVIII		Aberdeen	·96	...	·23	27	16	53·4	23	14·6	3	19	27
,,		Portree	10·19	— 5·44	2·24	27	22	...	...	...	...	...	...
,,		Inverness (Culloden)	1·31	— ·62	·48	29	6	51·0	15	16·5	3	13	26
XIX.		Dunrobin	1·96	— ·44	·62	29	16	54·0	23‡	19·8	2	21	...
,,		Sandwick	3·19	— ·78	·49	3	23	52·0	23	21·8	4	8	15
XX.	IRELAND.	Caherciveen DarrynaneAbbey	1·96	...	·43	27	14	...	...	...	...	...	...
,,		Cork	...	...	...	...	...	...	...	...	...	...	...
,,		Waterford	1·28	— 3·14	·37	28	11	55·0	31	14·5	5	16	...
,,		Killaloe	3·43	— ·06	·95	30	10	55·0	31	5·0	5	20	...
XXI.		Portarlington	1·81	— 1·38	·42	27	16	55·0	28	12·0	4	16	...
,,		Monkstown, Dublin	1·02	— 1·60	·25	31	13	...	...	...	...	...	...
XXII.		Galway	3·13	...	1·10	31	11	58·0	28	19·0	5	11	...
XXIII		Waringstown	1·64	...	·38	27*	10	55·0	28	12·0	4	17	25
,,		Edenfel (Omagh)	2·46	...	·75	30	13	54·0	27§	6·0	1	13	...
..		Ballinful	...	...	...	...	...	...	..	...	...	...	...

* And 30. † And 31. ‡ And 24. § And 28.

\+ Shows that the fall was above the average; — that it was below it.

METEOROLOGICAL NOTES ON DECEMBER.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

CAMDEN SQUARE.—A month of fogs.

SELBORNE.—Barometric pressure very high, having been above 30·46 in. every day from 7th to 28th inclusive; max., 30·61 in. Prevailing wind, N. Heavy S on 5th.

HITCHEN.—The driest December but one for 30 years, the coldest but one for 30 years, and the highest barometric pressure since 1873.

BANBURY.—Mean temp. 32°. Bar. at 9 a.m. on 13th corrected and reduced, 30·78 in., and at 11 a.m. on 23rd, 30·785 in.

CULFORD.—A remarkably cold month (mean temp. only 30°·4), with much hoar frost and fog; only five nights on which the temp. did not fall below 32°, and ten days on which the max. did not exceed 32°. On the 6th the ther. registered 1°, and on the surface of the S —6°. Sudden change of weather during the night of the 27th, with great increase of temp. and high wind, which continued to the end of the month.

COSSEY.—A dry, cold month. Min. in air on 2nd 4°, and on S —8°; and on 7th 3°·5 in air, and —4°·5 on S.

BODMIN.—Mean temp. of month 37°·9, 5° below the average. Springs lower than they have been known for several years. The rainfall during October, November, and December, usually the wettest months, has been no less than 10·66 in. below the average of the previous 29 years. Heavy TS at 7 a.m. on 29th, with tremendous H squalls.

CIRENCESTER.—The third month with rainfall below the average. Very cold, with great prevalence of E. and N.E. winds.

SHIFNAL.—Less severe than Dec., 1878 (which was the coldest for 44 years or more). The ice was three inches thick on the 1st, and four inches by the 7th. Very little S; much fog, especially from 16th to 19th. Milder weather set in on 28th, with strong wind.

ORLETON.—Mean temp. of month about 8° below the average, and 0°·5 below that of Dec., 1878. Sky generally cloudy and fogs prevalent, and only a few fine days. Frost steady, with only an occasional thaw, till 27th, when warm weather with high wind set in. Very distant T was heard on 29th and 30th, and L was seen on the latter day. The rivers were all frozen over by the 3rd.

BOSTON.—Mean temp. of month 8°·5 below the average. During the first two weeks the weather was intensely cold, the mean temp. of that period being 24°, or 16° below the average. The mean min. temp. 17°, and the lowest reached was zero, on the 7th, which killed the leaves of laurels, privets, &c. The wind was generally very calm till the last few days. In Dec., 1878, the temp. fell to 14°; in Jan., 1871, to 5°; and in Dec., 1874, to 8°.

GRIMSBY.—The month was cold and dry till towards the close, when it became mild and moist.

MANSFIELD.—The six days from the 2nd to 7th were remarkable for their extremely low temperature; the max. on the 2nd was 25°, and on the four succeeding days only slightly higher; the ther. fell to 6°·5 on the 2nd, 6°·3 on the 3rd, 4°·4 on the 4th, 10° on the 5th, 4° on the 6th, and 3°·7 on the 8th. For the first half of the month the sky was generally free from clouds both day and night, but the air was misty. The latter half had a good deal of cloudy weather.

MANCHESTER.—On the whole dry and cold; fog more prevalent than usual, and on the 12th most intense, causing great inconvenience to traffic. The cold on the 7th was also very intense, and the temp. recorded was exactly the same as on Christmas Day, 1878, viz., 10°; at Alexandra Park, to the west of the city, 4°·5 was recorded. About 4 in. of S on 6th, the only heavy fall. Towards the end of the month the temp. rose considerably, and there was a heavy fall of R on the 31st.

NORTH SHIELDS.—Temp. —2°·0 on the S on 4th.

WALES.

HAVERFORDWEST.—The frost during the first five days very intense, the river Cleddy more or less completely frozen; with one or two slight thaws the frost continued till the 24th, and skating was enjoyed almost the whole of that time. The frost was a much drier and finer one than that of Dec., 1878, although it did not last so long, nor the temp. fall so low. Bar. exceptionally high throughout the month, highest reading 30·714 in. at 9 p.m. on 12th. Dense fog on 23rd and 24th. Terrific squalls, with T and L, from 0 a.m. to 6 a.m. on 30th.

SCOTLAND.

CARGEN.—For the first 13 days hard frost prevailed; last five days stormy and unsettled weather. The bar. for the first 26 days was unprecedentedly high.

HAWICK.—Thermometers at zero on 3rd, and 2° below zero on 11th, and many of the more tender shrubs are much injured—Aucubas, Japonicas, and Laurustinus completely blackened. The frost came somewhat unexpectedly, and neither gardeners nor husbandmen were prepared for it. Terrible wind and R on 27th.

ABERDEEN.—Mean temp. 35°·0, 3°·2 below the average of 22 years. Rainfall 2·46 in. below the mean of 22 years. A very changeable month, but on the whole dry and cold. The first fortnight was very cold.

PORTREE.—A cold stormy month, the first week very frosty, with a heavy fall of S on 4th. A strong gale from S. all day on 27th, with T, L, H, and R; a young woman killed on her way home from the hills; the month continued very stormy to the end.

CULLODEN.—Very severe frost during the first part of the month; snowfall slight; rainfall less than usual; heavy gale from S.W. on 29th, and weather boisterous till the close of the year.

SANDWICK.—The snowstorm which commenced on Nov. 29th continued with partial thaws till the 7th, when a continued thaw began, and the plains were clear of S by the 9th. After that the weather was remarkably fine and mild for the season till 27th, when it became wet and boisterous.

IRELAND.

KILLALOE.—Severe frost every night till 14th; very wild and stormy weather from 27th to close of month. Heavy T on 29th.

MONKSTOWN.—The driest December for 16 years, with the exception of 1871 and 1873. Frost of variable intensity, accompanied by slight S, prevailed till about the 20th, when a thaw set in. From 27th to end of month high westerly wind and great variation of temp.

WARINGSTOWN.—Hard frost from 1st till 13th, afterwards a very mild thaw. No R to speak of till 27th.

CLIMATOLOGICAL STATIONS.

SEVERAL correspondents have enquired whether returns from localities other than health resorts of established repute are desired. We cannot, of course, speak on behalf of the Meteorological Society, but we believe that the intention of the Council was to establish a series of stations which should give absolutely identical facts from all parts of the country, and that the reference to health resorts was mentioned to a great extent incidentally, and as one of the most obvious applications of the data when obtained. But similar data are equally required for agricultural purposes, and we, therefore, consider that no locality is excluded.

END OF VOL. XIV.